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The May, 1977 - July, 1977 issue of Oil Spill and Oil Pollution Reports is a quarterly compilation of oil pollution publications and ongoing project summaries. Presented in the report are: (a) summaries and citations of published literature and patents; (b) summaries and status of current research projects; and (c) current oil-related conferences. This report is submitted in partial fulfillment of EPA Grant No. R-805052 by the Marine Science Institute, University of California, Santa Barbara, under the sponsorship of the Environmental Protection Agency.

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May 1977 - July 1977

by

Penelope Melvin, Helmut Ehrenspeck, and Paul Nordin
Marine Science Institute
University of California
Santa Barbara, California 93106

Grant No. R805052

Project Officer

L. T. McCarthy, Jr.
Oil & Hazardous Materials Spills Branch
Industrial Environmental Research Laboratory-Cincinnati
Edison, New Jersey 08817

INDUSTRIAL ENVIRONMENTAL RESEARCH LABORATORY
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
CINCINNATI, OHIO 45268

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FOREWORD

When energy and material resources are extracted, processed, converted, and used, the related pollutional impacts on our environment and even on our health often require that new and increasingly more efficient pollution control methods be used. The Industrial Environmental Research Laboratory - Cincinnati (IERL-Ci) assists in developing and demonstrating new and improved methodologies that will meet these needs both efficiently and economically.

This report is a product of the above efforts. It cites current events, literature, research, patents, and other material relevant to the oil pollution abatement program and is published in an abstract format on a quarterly basis. As such, it serves as a basic reference document for all those interested in oil spill and oil pollution control. This project is part of the continuing program of the Oil and Hazardous Materials Spills Branch, IERL-Ci to assess and mitigate the environmental impact of oil pollution.

David G. Stephan
Director
Industrial Environmental Research Laboratory
Cincinnati

ABSTRACT

OIL SPILL AND OIL POLLUTION REPORTS is a quarterly bulletin designed to review current scientific and technical publications and research projects in the field of oil pollution. Subject coverage includes aquatic and terrestrial oil pollution with emphasis on the marine environment. This issue contains summaries of research projects and published information selected from the scientific and technical literature during the period May, 1977 through July, 1977.

The following sections are included in the report:

I. Reports, Publications, and Patents
II. Current Research Projects
III. Current Oil-Related Conferences

This report is submitted in partial fulfillment of EPA Grant No. R805052-01 by the Marine Science Institute, University of California, Santa Barbara, California, under the sponsorship of the Environmental Protection Agency.

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INTRODUCTION

OIL SPILL AND OIL POLLUTION REPORTS is a quarterly bulletin which reviews pertinent scientific and technical publications and research projects to provide its readers with current developments in the field of oil pollution. This issue contains summaries of articles, reports, patents, documents, and other materials relating to oil pollution published during the period 1974 to 1976 (Section I); summaries and status of current research projects (Section II); and current oil-related conferences (Section III).

Subject coverage includes aquatic and terrestrial oil pollution with emphasis on the marine environment. Items in Section I are categorized by seven major subdivisions which are divided into thirty-three specific subject categories. These are presented in the Table of Contents. Patents and patent applications are announced under appropriate subject categories. Subject and author indexes for entries in Section I are provided at the end of the report. A list of the periodicals reviewed in preparing this series appears in the Appendix.

Section II presents titles of active or recently completed oil pollution research projects, summaries of project objectives, and current status information and/or resulting publications rpovided upon request by the principal investigators or performing organization. Notices of research projects were obtained from the Smithsonian Science Information Exchange (SSIE); Maritime Research Information Service Abstracts; and Canada, Department of the Environment, Spill Technology Newsletter. Entries are arranged according to the same subject categories as in Section I and are ordered by serial number within each subject division. Some of the current projects listed in previous Oil Pollution Reports have been recently renewed. These projects have been relisted and headed by the same serial number as originally reported, followed by the work (renewal). Renewal entries are listed at the beginning of each subject category.

Section III, Current Oil-Related Conferences, contains descriptive information on recently held and upcoming conferences relevant to any aspects of oil pollution. Conference dates are listed; and, when information is available, titles, authors, and abstracts of conference papers are included. All information for this section was obtained from the periodicals reviewed (Appendix) and from responses to written inquiries concerning the meetings.

Entries in Section I and II have separate serial numbers. The letters preceding the serial numbers designate the following; C, reports, publications, and patents; and R, research projects.

ABBREVIATIONS

atm	atmosphere
bbl	barrel
°C	degrees Centigrade
cm	centimeter
dwt	dead weight ton
EIS	environmental impact statement
°F	degrees Fahrenheit
ft	foot
g	gram
gal	gallon
GLC	gas-liquid chromatography
gpd	gallons per day
gph	gallons per hour
gpm	gallons per minute
ha	hectare
hr	hour
i.e.	(id est), that is
in	inch
IR	infrared
kg	kilogram
km	kilometers
kn	knot
l	liter
lb	pound
LNG	liquefied natural gas
LOT	load on top
LPG	liquefied petroleum gas
m	meter
mg	milligram
mi	mile
min	minute
ml	milliliter
mm	millimeter
OCS	outer continental shelf
oz	ounce
PAH	polycyclic aromatic hydrocarbon
pH	the negative log of the H ion concentration
ppb	part per billion
ppm	part per million
sp.	species
TLC	thin-layer chromatography
U.S.	United States
USSR	Union of Soviet Socialist Republics
UV	ultraviolet
VLCC	very large crude carrier
wt	weight
yr	year
μ	micron
%	percent
/	per

ACRONYMS

API	American Petroleum Institute
BLM	Bureau of Land Management
CEQ	Council on Environmental Quality
EPA	Environmental Protection Agency
ERDA	Energy Research and Development Administration
FEA	Federal Energy Administration
IMCO	International Maritime Consultative Organization
NASA	National Aeronautics and Space Administration
NBS	National Bureau of Standards
NOAA	National Oceanic and Atmospheric Administration
NTIS	National Technical Information Service
UN	United Nations
USCG	United States Coast Guard (DOT)
USGS	United States Geological Survey
USDI	United States Department of Interior
USDA	United States Department of Agriculture
USN	United States Navy

SECTION I. REPORTS, PUBLICATIONS, AND PATENTS

A. OIL POLLUTION DETECTION AND EVALUATION

1. REPORTING

C-1005-77
BIG BLOWOUT IN NORTH SEA 'RARE' EVENT
Anon. 1977.
National Fisherman 58(2):43-A-44-A.

Oil spills, Offshore drilling, Spill containment, North Sea, *Well blowout

The April, 1977 North Sea oil well blowout from the Phillips Petroleum Company Platform Bravo is reported. The well was gushing over 185,000 l (49,000 gals) of oil per hour into the sea, and attempts to contain or clean up the spill were prevented by 3m seas.

C-1006-77
COSTLY PROBLEM OF WASTE OIL (news brief)
Anon. 1977.
Marine Pollution Bulletin 8(3):52.

Waste oil, Disposal, Economics, Health hazards, UK

The United Kingdom Department of the Environment's Waste Management Advisory Council Report, "An Economic Case Study of Waste Oil," indicates that 58,500 metric tons (65,000 tons) of high-quality oil are wasted annually in Britain causing pollution and health problems. Almost half of the oil wasted results from motorists in do-it-yourself oil changes. If this oil could be reprocessed, a £ 1.7 million reduction in the country's balance of payments debt would be realized.

C-1007-77
EKOFISK WELL KILLED; PROBE UNDERWAY (news brief)
Anon. 1977.
Oil and Gas Journal 75(19):36.

Oil spills, *Ekofisk blowout, Spill cleanup, North Sea, Norway

Capping operations which successfully ended the blowout on April 30, 1977, at Ekofisk field's Bravo platform well 14 are detailed. The blowout spilled a total of about 140,000 bbl of oil into the North Sea; only a small fraction has been recorded. Ongoing spill cleanup efforts are reviewed, and the ramifications for further North Sea oil development are considered.

C-1008-77
FIRST NORTH SEA OIL POLLUTION (news brief)
Anon. 1977.
Marine Pollution Bulletin 8(2):29-30.

Oil spills, North Sea, Beaches, Scotland

The first North Sea oil pollution was recorded on the 24th and 25th September, 1976, along the beaches of north-east Scotland. Samples of oil were analyzed, but they were indistinguishable from weathered oil samples of that area.

C-1009-77
NORTH SEA WELL BLOWOUT CREATES HAVOC (news brief)
Anon. 1977.
Chemical & Engineering News 55(18):6-7.

Oil spills, Offshore drilling, Spill containment, North Sea, *Ekofisk well blowout

A brief report on the recent Ekofisk offshore oil well blowout is presented, and the steps taken to prevent a platform fire, to cap the well, and to contain the oil spill are reported.

C-1010-77
OCEANS (news brief)
Anon. 1977.
Environmental Action 8(20):7.

Tankers, Safety, Pollution prevention, U.S., *Liberian registry laws

Measures to improve tanker safety in U.S. waters are presented and Liberian tanker registry laws are discussed. U.S. Congressional action and CIA operations are reported with reference to OPEC nations and possible oil embargoes.

C-1011-77
PHILLIPS WORKS TO KILL EKOFISK BLOWOUT (news brief)
Anon. 1977.
Oil and Gas Journal 75:128-129.

Oil spills, *Ekofisk blowout, Monitoring, Spill cleanup, North Sea, Norway

The first major oil spill in 8 years of North Sea drilling occurred with a well blowout at the Phillips platform well 14 on April 22, 1977, with an estimated outpouring of 20,000 to 25,000 bpd. Attempts to cap the well, and the spill response, slick monitoring, and cleanup measures are briefly reviewed.

C-1012-77
POLLUTION KILLS MORE SEABIRDS (news brief)
Anon. 1977.
Marine Pollution Bulletin 8(2):29.

Birds, Contamination, Monitoring, UK, *Bird mortality

Many more seabirds died as a result of oil pollution during the winter of 1975-1976 than in the previous winter along Britain's coasts. The survey, sponsored by the Royal Society for the Protection of Birds (RSPB) and the Seabird Group, is part of an international effort to monitor the effects of oil pollution on seabirds.

C-1013-77
ROUND THE WORLD NEWS - UNITED STATES (news brief)
Anon. 1977.
Marine Pollution Bulletin 8(2):30.

Environmental effects, Fisheries, Argo Merchant spill, Olympic Games spill

Possible damage to the environment caused by the "Argo Merchant" oil spill is discussed, and the preliminary hearing in New York of the suit filed by the New England fishermen against the tanker owners is reviewed. The "Olympic Games" spill is also described.

C-1014-77
THE TANKER FLAG FROM PARK AVENUE (news brief)
Anon. 1977.
Massachusetts Audubon 16(6):2-3.

Oil spills, Tankers, Argo Merchant spill, *Liberian registry

The Liberian shipping registry is reviewed in reference to the "Argo Merchant" oil spill and major oil spill incidents listed by the Center for Short-Lived Phenomena are reported. Of the 39 oil tanker spills in 1976, 14 of them were registered under the Liberian flag.

C-1015-77
OIL POLLUTION IN NORTHEAST ENGLAND
Bourne, W. R. P. 1977.
Marine Pollution Bulletin 8(4):73-74.

Oil slicks, Coasts, Contamination, Birds, Restoration, England

In February, 1977, some 700 oiled Guillemots were found along the coast of Yorkshire as a result of an offshore oil slick.

The author comments on two points which regard this incident: the inaction of the Nature Conservancy Council in conducting an aerial survey of the slick, and the suitability of techniques used by the Royal Society for the Protection of Birds to rehabilitate oiled birds.

C-1016-77
PRESENT STATE OF POLLUTION IN THE GULF OF TRIESTE (in Italian)
Catalfamo, E. 1976.
1975 Yearbook. Trieste, Italy, Parco Marino di Miramare, 1976. 117p.

Sources, Contamination, Hydrocarbons, Wastewaters, Italy, *Gulf of Trieste

The main sources of chemical (industrial wastes and hydrocarbon) and physical pollution of the Gulf of Trieste are briefly described. The author emphasizes the need for research work in this area, to be carried out at the Control Station of the Marine Park of Miramare.

[from Aquatic Sciences & Fisheries Abstracts 7(3):#7Q3046. 1977]

C-1017-77
OIL SPILLS, 1971-75, GULF OF MEXICO OUTER CONTINENTAL SHELF
Danenberger, E. P. 1976.
U.S. Geological Survey Circular 741. 47p.

Oil spills, OCS, Offshore drilling, Gulf of Mexico

Presented are statistics and a discussion of oil spills resulting from offshore operations on Federal oil and gas leases in the Gulf of Mexico. The total Gulf of Mexico oil spillage recorded during this period amounted to 51,427 bbl. Comparison of the volume spilled with the volume produced for Gulf of Mexico OCS operations results in a spillage rate of 0.0028%.

C-1018-77
ROUND-THE-WORLD NEWS. ISRAEL (news brief)
Dixon, T. R. 1977.
Marine Pollution Bulletin 8(5):101.

Spill cleanup, Oil transfer, Oil spills, Ports, Shorelines, Contamination, Israel, *Eilat Oil Terminal

During oil transfer operations at the Eilat Oil Terminal, a hose rupture resulted in the spillage of 50 tons of crude oil into the Gulf of Aquaba, causing contamination of 8 km of shoreline. Problems of spill containment and cleanup are briefly related. The Eilat Sea Pollution Control Station responsible for cleanup operations had inadequate manpower and equipment to combat the spill.

C-1019-77
SPILL IN PORTUGAL, A REPORT OF THE JAKOB MAERSK INCIDENT
Duerden, F. C. 1976.
Environmental impact and assessment report, EPS-8-EC-76-1. 32p.

Spill cleanup, Tankers, Portugal, *Jakob Maersk spill

The 88,000 dwt tanker, "Jakob Maersk", grounded off the port of Leixoes, Portugal in 1975. Cleanup operations involved both the Portuguese Army and Navy. The effects of the massive amount of oil spilled were relatively slight due to a well coordinated cleanup effort.

[from Selected Water Resources Abstracts 10(6):#W77-02752. 1977]

C-1020-77
OIL AND HAZARDOUS MATERIALS SPILL INFORMATION RETRIEVAL SYSTEM. USER'S MANUAL. (OHM-SIRS)
Environmental Protection Agency. Oil and Special Materials Control Division. 1975.
PB-243662/4ST. 17p.

Oil spills, Information systems, Manuals

"This manual is designed to provide guidance to those who prepare reports on spill episodes to the Division of Oil and Special Materials Control, and who expect to access the system for developing Regional analytical studies."

[from ERDA Energy Research Abstracts 2(5):#9099. 1977]

C-1021-77
POLLUTION PROBLEMS OF THE SETO INLAND SEA
Goto, M. 1975.
Pure and Applied Chemistry 42(1-2):155-166.

Environmental deterioration, Oil spills, Statistics, Japan, *Seto Inland Sea

The present state of pollution of the Seto Inland Sea of Japan is reviewed as an example of pollution of a confined aquatic environment. Of the 2283 cases of pollution reported in 1972, about 87% were due to oil; oil pollution was heaviest in waters fronting large cities, industrial zones, and areas of greatest vessel traffic.

[from Environmental Health and Pollution Control 11(1):#51. 1977]

C-1022-77
U.S. HIT BY TANKER ACCIDENTS (news brief)
Gwynne, P. 1977.
New Scientist 73(1033):3.

Argo Merchant spill, Tankers, Environmental effects, Fisheries, Spill cleanup, Liability

The Liberian oil tanker accidents of December, 1976, are reviewed and the "Argo Merchant" spill is discussed. New England fisheries are expected to have an overall catch reduction in 1981 due to fish tainting from toxins in the oil. The lack of adequate cleanup methods and tanker owner liability are discussed.

C-1023-77
THE MIZUSHIMA OIL SPILL - A TRAGEDY FOR JAPAN AND A LESSON FOR CANADA
Nicol, C. W. 1976.
Environment Canada - Environmental Assessment Report EPS-8-EC-76-2. 30p.

Oil spills, Fuel oil, Spill cleanup, Movement, Environmental effects, Japan, *Inland Sea

The rupture of an oil tank and loss of Bunker C fuel oil in the Mizushima refinery on the Inland Sea of Japan are described. More than 200,00 persons have been employed in the cleanup, assisted by over 38,000 vessels. The movement of oil, environmental effects, and cleanup operations are discussed.

[from Environmental Abstracts 7(2):#77-01065. 1977]

C-1024-77
SPILL CHOKES OFF CAPE SHELLFISHING (news brief)
Palmer, H. V. R., Jr. 1977.
National Fisherman 58(2):4-A.

Oil spills, Fuel oil, Contamination, Fisheries, Massachusetts, *Buzzards Bay, *Shellfish resources

About 310,000 l (80,000 gals) of fuel oil were spilled in Buzzards Bay, Massachusetts, in December, 1976. Cleanup operations removed less than one tenth of the spilled oil and much of it remained trapped in and under ice until spring. Since February, 1977, many shellfish areas of Buzzards Bay have been ordered closed due to oil contamination.

C-1025-77
BEWARE OF GREEKS BEARING OIL
Reiger, G. 1977.
Audubon 79(2):141-146.

Argo Merchant spill, Environmental effects, Tankers, *Liberian flag of convenience

A history of the life of the "Argo Merchant" oil tanker is given and the Liberian registered oil tanker disasters of 1976 are reviewed. The environmental concerns due to these oil spills are discussed in reference to the Liberian "flag of convenience".

C-1026-77
JOINT ANGLO-SOVIET ACTION AGAINST OCEAN POLLUTION (news brief)
Rich V. 1977.
Marine Pollution Bulletin 8(2):29.

Environmental protection, Baltic Sea, UK, USSR, *Joint UK/USSR committee

The United Kingdom and the USSR have formed a committee on environmental protection to study the problem of oil pollution, particularly in the Baltic Sea. Floating and shore collectors for dealing with oil polluted water are to be installed on Soviet vessels and offshore installations in the Baltic and on rivers discharging into the sea.

C-1027-77
FISHERMEN STAND TO GAIN IN LONG RUN (news brief)
Townes, B. 1977.
National Fisherman 57(11):3A, 28A, 30A-31A.

Argo Merchant spill, Tankers, Legislation, Fisheries, USCG, New England

Foreign tanker accidents and tanker traffic are discussed in the wake of the "Argo Merchant" spill. The author feels that new legislation and increased law enforcement by the U.S. Coast Guard is necessary to decrease tanker accidents and protect New England fisheries.

C-1028-77
INDUSTRIAL POINT SOURCES OF PETROLEUM: POLLUTION LOADS AND ECONOMIC PARAMETERS
Tuffey, T. J., and P. Ginsberg. 1976.
Staff report, NSF-RA-760381; Grant NSF-AEN74-14810.

Wastewaters, Refineries, Industries, Sources, Contamination, Economic effects, Information systems

The report comprises a data base which focuses on pollution and economic parameters of refinery and other industrial effluents. Included are sections that provide refinery petroleum load as determined by permit search and verification, other refinery parameters calculated by EPA guidelines, non-refinery petroleum load as determined by permit search, and an economic parameter of refinery residuals.

[from Government Reports Announcements 77(8):#PB-262 394/3GA. 1977]

C-1029-77
A REVIEW OF WORLD OIL SPILLAGES 1960-1975
Van Gelder-Ottway, S. 1976.
Marine Ecology and Oil Pollution. J. M. Baker (ed.). New York, John Wiley & Sons, 1976. p. 483-520. Institute of Petroleum/ Field Studies Council Meeting, Aviemore, Scotland, 1975.

Oil spills, Biological effects

Major spillages during 1960-1975, together with basic details of these incidents and any subsequent biological effects, are presented in a tabulated form.

C-1030-77
OIL SPILLS FROM TANKERS
Wardley-Smith, J. 1976.
Marine Ecology and Oil Pollution. J. M. Baker (ed.). New York, John Wiley & Sons, 1976. p. 473-481. International Petroleum/ Field Studies Council Meeting, Aviemore, Scotland, 1975.

Oil spills, Sources, Tankers, Ships

The various ways by which spilled oil enters the marine environment are reviewed and indicate that vessel accidents of all kinds account for only 10% of the total amount of oil in the marine environment. Causes and sources other than the localized vessel accidents must be identified in dealing with oil pollution of large waterbodies.

2. MONITORING

C-1031-77
CURRENT MEASUREMENTS IN THE BEAUFORT SEA
Aagaard, K., and D. Haugen. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigator's Reports for the Year Ending March 1976. Vol. 11. p.11-12.

Monitoring,*Ocean currents, OCS, Offshore development, Fate, Contaminants, Beaufort Sea, Baseline studies

Current measurements were made so as to describe and understand the circulation and dynamics of the outer shelf and slope. The circulation and exchange between the shelf and the deep Arctic Ocean are physical meachanisms which transport and disperse pollutants and substances of biological and geological importance.

[from Selected Water Resources Abstracts 10(7):#77-03228. 1977]

C-1032-77
PRELIMINARY INVESTIGATIONS OF THE SUBLITTORAL MACROFAUNA OF MILFORD HAVEN
Addy, J. M. 1976.
Marine Ecology and Oil Pollution. J. M. Baker (ed.). New York, John Wiley & Sons, 1976. p. 91-130. Institute of Petroleum/ Field Studies Council Meeting, Aviemore, Scotland, 1975.

Monitoring, Marine organisms, Benthos, Distribution, Sediments, UK, *Sublittoral macrofauna, *Milford Haven

Twenty-four sample stations on a variety of substrates were sampled in May, 1974, in Milford Haven in order to identify communities within the Haven and the spatial and numerical distribution of these communities in relation to the sediment. Little evidence has been found for the existence of classical benthic "communities" in Milford Haven. Data show a high degree of overlap in the distribution of different species. Proposals for a monitoring scheme for the study area are discussed.

C-1033-77
'BUTTON' SENSOR A NEW TOOL IN COMBATING MARINE POLLUTION (news brief)
Anon. 1977.
Sea Technology 18(2):34-35.

Monitoring, Oil slicks, Pollution prevention, Ballast, Tankers, *Oil-water interface

A button-size sensor made of lead zirconate and lead titanate can determine within 0.1 mm the thickness of an oil layer on the surface of water and the exact point of the oil-water interface. One application of this device would be in the oil cargo tanks of tankers to monitor ballast discharging.

C-1034-77
EXPERT CONSULTATION ON THE JOINT CO-ORDINATED PROJECT ON POLLUTION IN THE MEDITERRANEAN
Anon. 1975.
Paris, Unesco, 1975. (U.S. distributor: UNIPUB, New York.) 69p.

Monitoring, Contaminants, Hydrocarbons, Coasts, Mediterranean Sea, Baseline studies, *Pollutant transport.

This project, jointly undertaken by the Intergovernmental Oceanographic Commission and World Meteorological Organization, developed the operational documents for two pilot projects: baseline studies and monitoring of oil and petroleum hydrocarbons, and coastal transport of pollutants. Project objectives and plans for operation are discussed.

[from Oceanic Abstracts 14(1):#77-00672. 1977]

C-1035-77
PUGET SOUND SPILL STUDIES
Anon. 1977.
Petroleum Engineer International 49(5):16.

Monitoring, Sediments, Mollusks, Puget Sound, Environmental effects, Oil spills, NOAA, Baseline studies

A study of petroleum found in sediments and mussels in the Strait of Juan de Fuca and northern Puget Sound is aimed at determining existing conditions in order to assess any changes that may be caused by possible future oil spills in the sound. This area is expected to be a major receiving port for shipments of Alaskan oil. The study is being conducted by the National Oceanic and Atmospheric Administration.

C-1036-77
SHIPBOARD OIL-IN-WATER MONITORING (news brief)
Anon. 1977.
Analytical Chemistry 49(3):314A.

Monitoring, Oil discharges, Bilges, Ballast, Ships

The U.S. Coast Guard and Navy are funding efforts at Baird-Atomic, Inc., to develop a prototype oil-in-water monitor suitable for monitoring shipboard bilge and ballast water. The proposed device will test this water before being discharged overboard, sound an alarm, and instigate corrective actions if the oil level in the water exceeds present maximums.

C-1037-77

BIOLOGICAL MONITORING - PRINCIPLES, METHODS AND DIFFICULTIES

Baker, J. M. 1976.
Marine Ecology and Oil Pollution. J. M. Baker (ed.). New York, John Wiley & Sons, 1976. p. 41-53. Institute of Petroleum/ Field Studies Council Meeting, Aviemore, Scotland, 1975.

Monitoring, Contaminants, Estuaries, Coasts, *Methods, *Indicator organisms

Presented are different approaches and methods of monitoring estuarine and coastal areas which include a discussion of different types of indicator organism, and a description of the shore transect technique used in several monitoring programs. An outline program for a typical estuary is given.

C-1038-77

EFFECTS OF SEASONABILITY AND VARIABILITY OF STREAMFLOW ON NEARSHORE COASTAL AREAS

Carlson, R. F. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 11. p.23-73.

Monitoring, *Streamflow, Estuaries, Coasts, Offshore development, Oil spills, Environmental effects, Alaska, Baseline studies

Streamline variability, the effects of seasonal ice, as well as sediment characteristics and ice jam flooding have considerable impact on nearshore and estuarine areas. Estuarine and shorefast areas of the Bering, Chukchi and Beaufort Seas are presently being developed and leased as part of the OCS program. Statistical characterization and the methods used to measure the title parameters in 41 streams are described.

[from Selected Water Resources Abstracts 10(7):#W77-03229. 1977]

C-1039-77

WATER POLLUTION MONITOR

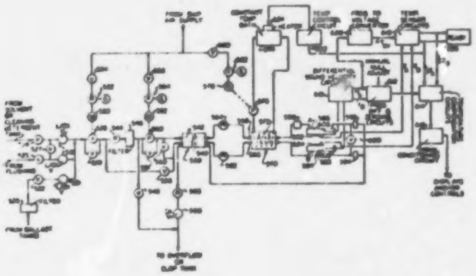
Cirulis, U., and E. M. Zacharias, Jr. 1976.
U.S. Patent 3,973,430

Monitoring, Hydrocarbons, Petroleum products, Ballast, Wastewaters, Patent, *Sound velocity characteristics

A method of determining the concentration of oil, petroleum products, and hydrocarbons in water using sound velocity characteristics is described. This method can be used to measure the concentration of oil contained in the ballast of tankers and in the effluent from refineries.

[from Selected Water Resources Abstracts 10(4):#W77-01722. 1977]

3,973,430
WATER POLLUTION MONITOR
Uldis Cirulis, Midland Park, and Ellis M. Zacharias, Jr., Ridgewood, both of N.J., assignors to Process and Pollution Controls Company, Tulsa, Okla.
Continuation-in-part of Ser. No. 383,405, July 27, 1973, Pat. No. 3,892,127. This application Mar. 11, 1975, Ser. No. 557,393
Int. Cl.^{2} G01N *29/02*
U.S. Cl. 73—61.1 R 60 Claims



C-1040-77

DISTRIBUTION OF LIGHT HYDROCARBONS, C_1-C_4, IN THE NORTHEAST GULF OF ALASKA AND THE SOUTHEASTERN BERING SHELF
Cline, J., and R. Feely. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 9. p.443-550.

Monitoring, Hydrocarbons, Distribution, OCS, Offshore development, Gulf of Alaska, Bering Sea, *Naturally-occurring hydrocarbons, Baseline studies

Data are being collected on spatial and temporal variations of the dissolved hydrocarbon fraction in order to establish baseline levels of naturally-occurring hydrocarbons in lease areas prior to oil exploration and production. These components have proven to be valuable indicators of petroleum input arising from drilling, production, and transport of crude oil and refined products.

[from Selected Water Resources Abstracts 10(7):#77-03221. 1977]

C-1041-77
OIL SPILL CLEANUP OPERATIONS MONITORED BY REMOTE DEVICE
Cook, P. P. 1977.
Pollution Engineering 9(5):44-45.

Monitoring, Contamination, Groundwater, Spill cleanup, Design and engineering

Described is an oil layer thickness detector based upon capacitance measurements which can be inserted into drill test wells around a spill area to monitor the amount of oil seepage in an aquifer. The data collected indicates the effectiveness or progress of spill cleanup operations.

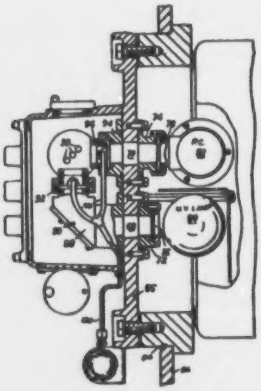
C-1042-77
INSTALLATIONS FOR MONITORING OIL CONTENT
DeVial, R. M. 1976.
U.S. Patent 3,965,920

Monitoring, Oil slicks, Ballast, Tankers, Design and engineering, Patent

Installations for monitoring the oil content in a stream of water and in a discharge of water ballast from an oil tanker are described. A photo-electric alarm system based on incoming fluorescent radiation is presented.

[from Selected Water Resources Abstracts 10(3):#W77-01195. 1977]

3,965,920
INSTALLATIONS FOR MONITORING OIL CONTENT
Raymond Michael deVial, Beckenham, England, assignor to Bailey Meters & Controls Ltd., Croydon, England
Filed Oct. 3, 1974, Ser. No. 511,748
Claims priority, application United Kingdom, Oct. 3, 1973, 46274/73
Int. Cl.^{2} G05D *7/06*; F16K *37/00*
U.S. Cl. 137—115 **4 Claims**



C-1043-77
OFFSHORE BIOLOGICAL MONITORING
Dicks, B. 1976.
Marine Ecology and Oil Pollution. J. M. Baker (ed.). New York, John Wiley & Sons, 1976. p. 325-340. International Petroleum/ Field Studies Council Meeting, Aviemore, Scotland, 1975.

Monitoring, Marine organisms, Offshore development, Baseline studies, North Sea, Celtic Sea

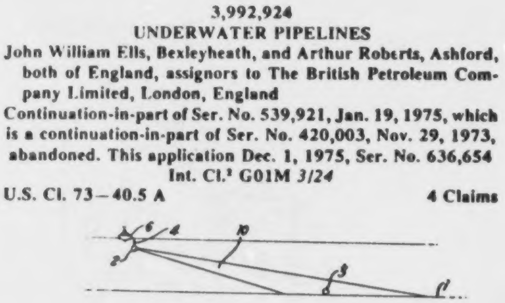
The selection of suitable marine organisms for an offshore biological monitoring program and the requirements and problems of offshore monitoring design are discussed with reference to oil developments in the North and Celtic Seas. Data from a baseline study in the North Sea are used to illustrate the problems of monitoring and the importance of sample number to the quantification of data.

C-1044-77
UNDERWATER PIPELINES
Ells, J. W., and A. Roberts. 1976.
U.S. Patent 3,992,924

Monitoring, Leakage, Pipelines, Detection, Patent, *Mobile receiver

Leaks from underwater oil pipelines are detected and located by a mobile receiver which moves along a path parallel to the pipeline and detects the ultrasonic frequencies in the 20 to 70 kHz range that are generated by liquid escaping from a leak.

[from Petroleum Abstracts 17(11):#231,472. 1977]



3,992,924
UNDERWATER PIPELINES
John William Ells, Bexleyheath, and Arthur Roberts, Ashford, both of England, assignors to The British Petroleum Company Limited, London, England
Continuation-in-part of Ser. No. 539,921, Jan. 19, 1975, which is a continuation-in-part of Ser. No. 420,003, Nov. 29, 1973, abandoned. This application Dec. 1, 1975, Ser. No. 636,654
Int. Cl.^{2} G01M *3/24*
U.S. Cl. 73–40.5 A **4 Claims**

C-1045-77

THE EVALUATION OF AN OILSPILL TRACKING BUOY
Fingas, M. 1977.
Spill Technology Newsletter 2(1):31-36.

Monitoring, Oil slicks, Design and engineering, *Spill tracking buoy

Results of preliminary laboratory evaluations and field testing of the Orion Spill Tracking Buoy are discussed. In a simulated spill situation the buoy appeared to behave dynamically like an oil slick and stayed within the slick for a period of several hours. Further testing and development are planned.

C-1046-77

TOWARD A GLOBAL MONITORING PROGRAM FOR TRANSURANICS AND OTHER MARINE POLLUTANTS
Goldberg, E. D. 1976.
Environmental Toxicity of Aquatic Radionuclides: Models and Mechanisms. M. W. Miller and J. N. Stannard (eds.). Ann Arbor, Michigan, Ann Arbor Science Publishers Inc., 1976. p. 3-10.

Monitoring, Contaminants, Mollusks, Crustaceans, Cost analysis, *Mussels, *Barnacles, *Global monitoring program

Four pollutants that threaten the marine environment have been identified: petroleum, radioactive nuclides, heavy metals, and halogenated organic compounds. A global monitoring program based on two sentinel organisms, mussels and barnacles, is proposed and detailed; costs of collection and analyses for 100 samples should be under $300,000.

[from ERDA Energy Research Abstracts 2(7):#18266. 1977]

C-1047-77

GULF OF ALASKA STUDY OF MESOSCALE OCEANOGRAPHIC PROCESSES (GAS-MOP)
Hayes, S. P., and J. D. Schumacher. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 11. p. 75-106.

Monitoring, Oceans, *Circulation patterns, OCS, Gulf of Alaska, Offshore development, Environmental effects

The objective of this research is to describe the mesoscale oceanic circulation on the continental shelf, Gulf of Alaska, in order to characterize the intermediate scale advective and diffusive processes. These processes are important to the assessment of potential pollution problems due to OCS petroleum development. Data collected to date are discussed.

[from Selected Water Resources Abstracts 10(7):#W77-03230. 1977]

C-1048-77
CLOSING SUMMARY AND FINAL DISCUSSION ON MONITORING
Holdgate, M. W. 1975.
Institute of Petroleum/Field Studies Council Meeting on Marine Ecology and Oil Pollution, Scotland, 1975. p. 525-550.

Monitoring, Oil discharges, Environmental protection, Oil industry, Government agencies

Oil monitoring techniques and the effects of oil discharges on the environment are reviewed. The interaction of oil industry, government, and private environmental protection organizations in monitoring and eliminating oil pollution and its effects is examined.

[from Environment Abstracts 6(12):#76-08014. 1976]

C-1049-77
A NOVEL SUMMING LUMINESCENCE SPECTROMETER EMPLOYING POLYCHROMATORS AND SPATIAL FILTERING
Hornig, A. W., and B. R. Chisholm. 1976.
Proceedings of the Society of Photo-Optical Instrumentation Engineers 82:97-102.

Monitoring, Analytical techniques, Spectrometry, Detection, Bilges, Ballast, Waste oil, *Summary luminescence spectrometry

Luminescence methods are considered very advantageous for continuous oil-in-water monitoring because of their high sensitivity and relative immunity to particulate backgrounds. Summing luminescence spectrophotometry is a solution to the problem of detecting total oil content of shipboard bilge and ballast water because the method retains these advantages, has a short response time, and eliminates the mechanical scanning of emission wavelengths of different waste oil types.

[from Chemical Abstracts 86(20):#148674u. 1977]

C-1050-77
APPARATUS TO DETERMINE OIL IN WATER DRAINING FROM AN OFFSHORE DRILLING RIG
Hubby, L. M. 1975.
German Patent 2,340,807

Monitoring, Offshore drilling, Design and engineering, Patent, *Oil-in-water

Water is led through the deck into a vertical, longitudinal container that forms part of a U-tube. The outlet leg, containing a liquid at a constant height, consists of an open vertical pipe reaching to the bottom of the container and discharging through the wall above sea level. The inlet leg is the liquid in the container. When a liquid of different density such as oil enters, its level is higher than that in the outlet leg; a float operates a pneumatic valve that sets off an alarm or shuts off the delivery of liquid to the container.

C-1051-77
RECORDING BIOELECTRIC ACTION POTENTIALS OF MARINE DECAPOD CRUSTACEA BY REMOTE ELECTRODES: A BIOASSAY PROCEDURE FOR MONITORING HYDROCARBON POLLUTION
Idoniboye-Obu, B. 1977.
Environmental Pollution 12(3):159-166.

Monitoring, Hydrocarbons, Seawater, Crustaceans, *Motor behavior

The motor behavior of mechanically unimpeded crustaceans was used to determine lethal concentrations of hydrocarbons soluble in water and to monitor water pollution by oil. Bioelectric action potentials were picked up by appropriate non-polarizing electrodes in seawater and the level of animal activity was found to be proportional to hydrocarbon concentrations.

C-1052-77
THE ADENYLATE ENERGY CHANGE AS AN ESTIMATE OF STRESS IN AN ESTUARINE MOLLUSC
Ivanovici, A. 1976.
Australian Marine Science Bulletin No. 55:5-6.

Monitoring, Metabolism, Mollusks, Estuaries, Contamination, Hydrocarbons, *Adenylate energy charge, *Environmental stress

The adenylate energy charge, which gives a measure of metabolic energy stored in the adenylate pool of an organism, may provide a reliable technique for measuring and monitoring the effects of environmental changes on estuarine organisms. Results are given of experiments in which the estuarine snail, Pyrazus ebenius, was exposed to various environmental conditions, including transfer to sites with different levels of hydrocarbon pollution in the Parramatta River, and the energy charge was measured.

[from Aquatic Sciences & Fisheries Abstracts 7(3):#7Q3127. 1977]

C-1053-77
APPARATUS AND METHOD FOR DETECTING TRACES OF OIL IN LIQUIDS OF DIFFERENT SPECIFIC GRAVITY, ESPECIALLY WATER
Lambrich, K. H., H. W. Meyer, and G. Tiemann. 1976.
German Offenlegungsschriften (unexamined patent application) 2,520,014

Monitoring, Contaminants, Detection, *Oil-in-water, Patent

Oil in water is detected by introducing a water sample through an upright pipe at a rate sufficiently slow to allow oil to float to the surface. Platinum electrodes placed a few millimeters below the surface detect oil which interrupts conductivity. After measurements, the pipe is rinsed and a new sample is introduced.

[from Chemical Abstracts 86(14):#95626w. 1977]

C-1054-77
MONITORING OF PETROLEUM HYDROCARBONS
Lee, R. F. 1976.
Manual of Methods in Aquatic Environmental Research. Part 2 - Guidelines for the Use of Biological Accumulators in Marine Pollution Monitoring. J. E. Portmann (ed.). Rome, Food and Agricultural Organization of the United Nations, 1976. p. 38-47. (FAO Fisheries Technical Paper No. 150)

Monitoring, Hydrocarbons, Marine organisms, Analytical techniques, Uptake, Metabolism

Analytical studies of the uptake, bioaccumulation, and metabolism of petroleum hydrocarbons in marine animals are reviewed. The relation of these studies to the selection of marine organisms for monitoring hydrocarbons is examined. Based on present evidence, bivalves, specifically clams, oysters and mussels, appear to be a group of animals which are suitable for monitoring purposes.

C-1055-77
RARE EARTH ELEMENTS/NEUTRON ACTIVATION ANALYSIS METHOD FOR TRACING OILY WASTEWATER; A FEASIBILITY STUDY
McCown, D. L., W. Harrison, and W. Orvosh. 1976.
EOS 57(10):755. Abstract.

Monitoring, Waste oil, Refineries, Sampling, Wastewaters

Oily wastewater tagged with dysprosium was traced from the Indiana Harbor canal. The transport and dispersion of this simulated refinery waste is described and deficiencies in the experimental design are discussed. More frequent sampling and the use of an existing water sampling system are suggested for improving the study.

C-1056-77
TRANSFER TO FISH OF PETROLEUM PARAFFINS AND ORGANIC SULFUR COMPOUNDS
Ogata, M., Y. Miyake, S. Kira, K. Matsunaga, and M. Imanaka. 1977.
Water Research 11(4):333-338.

Monitoring, Crude oil, Fish, Chemical analysis, Chromatography, *Eels, *Bio-indicators

Eels were maintained in a controlled laboratory environment in water with crude oil. Gas chromatography of eel flesh revealed the presence of paraffins and sulfur compounds in which concentration increased with rearing time. Organic sulfur compounds may be used as an indicator of oil pollution in fish.

C-1057-77
HEAVY METALS AND PETROLEUM PRODUCTS IN THE NORTH, NORWEGIAN, AND BALTIC SEAS [English summary]
Petrov, Yu. M., O. B. Starinkova, and Z. N. Kurpyakova. 1976.
Okeanologiya (Moscow) 16(5):820-824.

Monitoring, Petroleum products, North Sea, Norwegian Sea, Baltic Sea

The presence of petroleum products and heavy metals was investigated in 1972 and 1973 in the title areas. The Baltic Sea is polluted mostly by petroleum products both on the surface and in the water column. An increase in petroleum pollution was noted between 1972 and 1973.

[from Chemical Abstracts 86(18):#126921v. 1977]

C-1058-77
MANUAL OF METHODS IN AQUATIC ENVIRONMENT RESEARCH. PART 2. GUIDELINES FOR THE USE OF BIOLOGICAL ACCUMULATORS IN MARINE POLLUTION MONITORING
Portmann, J. E. 1976.
Fisheries technical paper, FAO-FIRI/T150, NSF/IDOE-77-6. 12p.

Monitoring, Hydrocarbons, Mollusks, Uptake, Release, Metabolism, Manuals

In an area affected by oil pollution, the tissues of certain marine organisms may reflect the total concentration of petroleum and the relative amounts of different hydrocarbons in the water. Based on present evidence, bivalves, specifically clams, oysters and mussels, appear to be a group of animals which are suitable for monitoring petroleum hydrocarbons. Part 2 of the report deals with biological transfer and transformation processes such as uptake and bioaccumulation, biogenic hydrocarbons, and hydrocarbon metabolism.

[from Government Reports Announcements 77(9):#PB-263-249/5GA. 1977]

C-1059-77

NEAR SHORE ATMOSPHERIC MODIFICATION

Reynolds, R. M., and B. Walter. 1976.
Environmental Assessment of the Alaskan Continental Shelf.
Principal Investigators' Reports for the Year Enging March 1976.
Vol. 12. p. 87-213.

Monitoring, *Wind conditions, Offshore development, Fate, Contaminants, Coasts, Alaska, Baseline studies

A thorough knowledge of coastal wind conditions is an important consideration in offshore industrial development through its effects on mean flow and the trajectory of surface contaminants. The study is designed to define which processes are acting to modify coastal winds, how prevalent they are, and how far off shore they act.

[from Selected Water Resources Abstracts 10(7):#W77-03242. 1977]

C-1060-77

MESOSCALE CURRENTS AND WATER MASSES IN THE GULF OF ALASKA

Royer, T. C. 1976.
Environmental Assessment of the Alaskan Continental Shelf.
Principal Investigators' Reports for the Year Ending March 1976.
Vol. 11. p. 293-358.

Monitoring, *Ocean currents, Fate, Contaminants, Offshore development, Gulf of Alaska, Baseline studies

The study was aimed at defining the physical-chemical environment, transport of pollutants, and the long-term monitoring of the physical-chemical environment in the Gulf of Alaska.

[from Selected Water Resources Abstracts 10(7):#W77-03236. 1977]

C-1061-77

MARINE CLIMATOLOGY OF THE GULF OF ALASKA AND THE BERING AND BEAUFORT SEAS. PART III. CLIMATIC ATLASES

Searby, H. W., and W. A. Brower, Jr. 1976.
Environmental Assessment of the Alaskan Continental Shelf.
Principal Investigators' Reports for the Year Ending March 1976.
Vol. 11. p. 770-786.

Monitoring, *Marine climatology, Offshore development, Environmental effects, Gulf of Alaska, Bering Sea, Beaufort Sea, Baseline studies

The study will provide three atlases to represent the total of the Alaskan waters and each will be based on more than 20 years of additional marine data. Descriptive climatology and data analyses of marine and atmospheric parameters are being conducted to determine if results have the necessary temporal and spatial resolution to provide an assessment of risks involved in operating energy-related structures in these waters.

[from Selected Water Resources Abstracts 10(7):#W77-03240. 1977]

C-1062-77

HYDROCARBONS: NATURAL DISTRIBUTION AND DYNAMICS ON THE ALASKAN OUTER CONTINENTAL SHELF

Shaw, D. G. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Enging March 1976. Vol. 10. p. 193-366.

Monitoring, Hydrocarbons, Distribution, Fate, OCS, Alaska, Baseline studies

The objective of this project is to measure the kinds and amounts of hydrocarbons in various components of the Alaskan OCS environment and to study processes by which added hydrocarbons are transported and degraded in this environment. It appears that hydrocarbon levels are as low as, or lower than other areas of the ocean not subject to petroleum pollution.

[from Selected Water Resources Abstracts 10(7):#W77-03224. 1977]

C-1063-77

UPTAKE AND RELEASE OF PETROLEUM BY INTERTIDAL SEDIMENTS AT PORT VALDEZ, ALASKA

Shaw, D. G., L. M. Cheek, and A. J. Paul. 1977.
Estuarine and Coastal Marine Science 5(3):429-436.

Monitoring, Crude oil, Sediments, Uptake, Release, Intertidal zone, Alaska, *Port Valdez

The uptake and release of Prudhoe Bay crude oil by intertidal sediments at Port Valdez, Alaska, were simulated in two experiments. Oil was spread on sediments daily at two different rates for five days and hydrocarbon content of the top centimeter of the sediments was monitored for 60 days from the first oiling. In both experiments oil was no longer detectable on the 60th day. Possible reasons for this loss of petroleum by sediments are discussed.

C-1064-77
PIPELINE LEAK DETECTORS
Swiss, M. 1976.
Processing 22(12):27.

Monitoring, Leakage, Pipelines, Oil transport, *Pipeline leak detectors

Two methods of detecting leaks in oil pipelines are described. A leak detector developed by the Royal Dutch Shell laboratories moves along the inside of the pipeline, propelled by pumping pressure, and detects and records the ultrasonic noise caused by escaping fluids. The other instrument, developed by Westinghouse, provide indirect evidence of leakage by detecting changes in flow rate with extreme accuracy.

[from Petroleum Abstracts 17(11):#231,294. 1977]

C-1065-77
DEVELOPMENT OF A NEW DETECTOR FOR OIL IN WATER
Thyrum, P. T. 1975.
Interim report, NAPTC-PE-51. 17p.

Monitoring, Fuel oil, Bilges, Detection, Ships, Design and engineering, *Oil-in-water detector

A new shipboard detector was developed for the quantitative analysis of undissolved oil present in water over a 0-30 ppm concentration range. Measurements were not influenced by common surfactants and could be performed by non-technical personnel. Read out could be obtained by visual color-intensity matching or by a reflectance meter.

[from Government Reports Announcements 77(10):#AD-A036 367/1GA. 1977]

C-1066-77
MONITORING OF AQUATIC POLLUTION
Tomczak, G. 1976.
Second FAO/SIDA Training Course on Marine Pollution in Relation to Protection of Living Resources: Methods for Detection, Measurement and Monitoring of Pollutants in the Aquatic Environment. Rome, UN Food and Agriculture Organization, 1976. p. 92-109.

Monitoring, Contaminants, Pollution prevention, UN

Topics discussed are the concept of an integrated marine pollution monitoring program, existing monitoring activities, pollutants, and an outline for a UN monitoring program in developing countries. Categories of pollutants to be monitored include petroleum, halogenated hydrocarbons, heavy metals, and transuranics.

[from Oceanic Abstracts 14(2):#77-01640. 1977]

C-1067-77
DETERMINATION OF THE TOTAL CONTENT OF AROMATIC HYDROCARBONS IN REFINERY AND PETROCHEMICAL WASTES BY COLORIMETRIC METHODS [English summary]
Urbanski, J., and A. Superson. 1976.
Chemia Analityczna (Warsaw) 21(4):955-961.

Monitoring, Aromatic hydrocarbons, Wastewaters, Refineries, Chemical analysis, *Colorimetry

Total aromatic hydrocarbons in sewage were determined using a color reaction with HCHO and H_2SO_4; examples of the results are presented.

[from Chemical Abstracts 86(8):#470008z. 1977]

C-1068-77
APPARATUS FOR DETECTING OIL IMPURITIES IN WATER
Webb, M. G. 1976.
German Offenlegungsschriften (unexamined patent application) 2,606,746

Monitoring, Contaminants, Crude oil, Fuel oil, Detection, Design and engineering, Patent, *Optical sensor

An apparatus is described which optically detects crude or fuel oil in water and then sends a signal from the detection apparatus to another location by radio or submarine transmitter. Oil contacts an oleophilic plate in the detector, and the resultant change in light intensity is detected by a photoelectric cell which converts the signal into an electric signal that is broadcast.

[from Chemical Abstracts 86(18):#127068j. 1977]

C-1069-77
APPARATUS FOR DETECTING OIL SPREAD ON THE SURFACE OF WATER
Webb, M. G. 1976.
French Patent 2,302,522

Monitoring, Oil slicks, Design and engineering, Patent, *Light sensor

A floating apparatus for detecting oil slicks is described which consists of a submerged rotating disk, a light emitting source, and a sensor which records changes in light intensity due to the presence of floating oil.

[from Petroleum Abstracts 17(15):#232,319. 1977]

C-1070-77
DISTRIBUTION OF TAR AND OTHER PARTICULATE POLLUTANTS ALONG THE BEAUFORT SEA COAST
Wong, C. S., D. MacDonald, and W. J. Cretney. 1976.
Canada Department of the Environment, Beaufort Sea Project technical report, No. 13. 96p.

Monitoring, Tar, Sources, Distribution, Coasts, Beaufort Sea

This report summarizes the data gathering methods and results of a baseline survey of the distribution and sources of particulate pollutants, especially tar and plastics in seawater, nearshore sediments and marine organisms of the Beaufort Sea coast. Tar and grease were rare and occurred as isolated objects. Plastics in the form of styrofoam fragments, polyethylene sheets, and containers were common; recommendations for their control are presented.

3. REMOTE SENSING

C-1071-77
No title given (news brief)
Anon. 1977.
Chemical & Engineering News 55(19):15.

Remote sensing, Oil slicks, Detection, USGS, *Landsat imagery

Oils slicks off the U.S. and other coasts have been detected on Landsat imagery according to U.S. Geological Survey research. The slicks are detectable because they remove the "glitter" from the water surface, thus showing up darker than surrounding water areas. This imagery capability may be useful in monitoring spills and guiding cleanup operations.

C-1072-77
OPERATIONS OF AN ALASKAN FACILITY FOR APPLICATIONS OF REMOTE-SENSING DATA TO OCS STUDIES
Belon, A. E. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 14 p. 409-456.

Remote sensing, OCS, Offshore development, Fate, Oil spills, Environmental effects, Contingency planning, Alaska

The acquisition of remote sensing data, especially satellite data, has proved to be a cost-effective method of monitoring the environment on a comprehensive scale. Demonstration projects have shown that Landsat data can be used effectively for developing models of suspended transport and therefore for preparing contingency plans based on the movement of oil spills in Alaskan coastal waters, planning navigation routes and offshore drilling structures where sea-ice is prevalent, and assessing the potential physical and biological impact of development on the coastal zone.

[from Selected Water Resources Abstracts 10(7):#W77-03277. 1977]

C-1073-77
STUDY OF THE EFFECT OF WAVES ON REMOTE SENSING OF OIL POLLUTION BY THE ACTIVE METHOD
Bogorodskiy, V. V., M. A. Kropotkin, and T. Yu. Sheveleva. 1976.
Oceanology 15(6):714-716.

Remote sensing, Contaminants, Baltic Sea, *Wind effects, *Wave effects

The effect of waves on the remote sensing ability of a laser oil pollution indicator is investigated using a special electrical model in the Baltic Sea at wind velocities from 3 to 15 m/sec^{-1}. Relations were obtained between the dynamic time constant, the constrast in reflectivity of polluted and unpolluted water, and wind velocity.

[from Environmental Health and Pollution Control 11(6):#1189. 1977]

C-1074-77
DEVELOPMENT AND FIELD TESTING OF A LIGHT AIRCRAFT OIL SURVEILLANCE SYSTEM (LAOSS)
Burns, W., and M. J. Herz. 1976.
Final report, NASA-CR-2739; CG-D-1-76. 28p.

Remote sensing, Oil slicks, Surveillance, Design and engineering

An experimental polarized light filtering system was designed to provide a remote means of discriminating the presence of oil on water surfaces. Flight tests of the instrument were conducted and are presented. The results indicate the potential usefulness of this airborne remote oil sensing system.

[from Government Reports Announcements 77(3):#N76-33472/1GA. 1977]

C-1075-77
PERFORMANCE OF COHERENT-ON-RECEIVE SYNTHETIC APERTURE SIDE LOOKING AIRBORNE RADAR
Fraser, D. E., and G. V. Morris. 1976.
Final report, GED-2213, USCG-D-109-76. Contract F42600-75-A-1661. 165p.

Remote sensing, Oil slicks, Detection, Oceans, Design and engineering

The Coast Guard's oil slick detection system was modified to add a synthetic aperture mode. Improvement in resolution by a factor of 10 and imaging of the ocean surface and moving vessels were demonstrated. Experimental oil slicks were detected by the synthetic aperture radar at a range of 25 km under 18.5 km/hr (10 kn) wind conditions and at 9 km under 7.4 km/hr (4 kn) wind.

[from Government Reports Announcements 77(8):#AD-A035 032/2GA. 1977]

C-1076-77
LIDAR ENERGETICS DURING REMOTE DETECTION OF OIL SLICKS ON THE SEA [in Russian]

Gurevich, I. Ia., and K. S. Shifrin. 1976.

Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana 12: 863-867.

Remote sensing, Oil slicks, Seawater, *Lidar energetics

An estimate is made of the energy entering the input of a lidar receiver system, utilizing a CO_2 laser, during remote sounding of the sea. "It is found that the energy entering the input decreases with an increase in wind speed from 2 to 15 m/s during nadir ranging, but sharply increases during ranging at an angle of 20 deg." An example is examined which allows estimation of the ranging height from which an oil slick on the sea can be detected with a CO_2 lidar system.

[from International Aerospace Abstracts 17(4):#A77-14731. 1977]

C-1077-77
SATELLITE AND CURRENT DROGUE STUDIES OF OCEAN-DISPOSED WASTE DRIFT
Klemas, V., G. R. Davis, and R. D. Henry. 1977.
Journal Water Pollution Control Federation 49(5):757-763.

Remote sensing, Monitoring, Oil slicks, Movement, *Satellite-aircraft-drogue studies

A satellite-aircraft-drogue approach has been developed which employs remotely tracked expendable drogues and satellite and aircraft remote sensing techniques as a cost effective means of monitoring oil slick movement, current circulation, and ocean waste dispersion.

C-1078-77

A COST-EFFECTIVE SATELLITE-AIRCRAFT-DROGUE APPROACH FOR STUDYING ESTUARINE CIRCULATION AND SHELF WASTE DISPERSION
Klemas, V., G. R. Davis, H. Wang, W. Whelan, and G. Tornatore. 1975.
Report no. CMS-NASA-5-75. p. 751-760.

Remote sensing, Wastewaters, Estuaries, OCS, Dispersions, *Current circulation

A cost-effective method of monitoring current circulation and ocean waste dispersion along the continental shelf is discussed. An integrated satellite-aircraft-drogue system remotely tracks expendable drogues together with satellite observations of waste plumes and natural tracers to provide a means of determining currents in this area.

[from Selected Water Resources Abstracts 10(9):#W77-04492. 1977]

C-1079-77

REMOTE DETECTION OF OIL SPILLS ON THE OCEAN SURFACE USING A LASER [English summary]
Kolenko, E. A., E. N. Zhmin'ko, G. L. Kravtsov, A. A. Besedin, and L. N. Radaikina. 1975.
Morskie Gidrofizicheskie Issledovaniya No 3:233-238.

Remote sensing, Oil slicks, Detection, Oceans, *Lasers

The possibility of using a Ga As laser for the remote detection of oil slicks on water is investigated. The signals are well defined, easily recordable, and the reflectivity of oil is greater than that of pure seawater. Reflectivity of oil films of various thicknesses on calm and rough seas are compared.

[from Chemical Abstracts 86(12):#782412. 1977]

C-1080-77

USING LINEAR PROGRAMMING TO DESIGN OIL POLLUTION DETECTION SCHEDULES
Olson, D. G., et al. 1976.
American Institute of Industrial Engineers Transactions and Proceedings 8(3):350-357.

Remote sensing, Oil spills, Detection, Models, Pollution prevention, Coasts, *Linear programming

A flight scheduling system is presented for infrared and ultraviolet sensor equipped aircraft whose mission is the detection and prevention of coastal and harbor oil spills. The model is a form of the stochastic traveling salesman problem which can be solved using linear programming. Input parameters representing probabilities of pollution incidents occurring for different geographical sectors are required and the objective is to maximize the expected number of pollution incidents detected per flight.

[from Environment Abstracts 7(3):#77-01831. 1977]

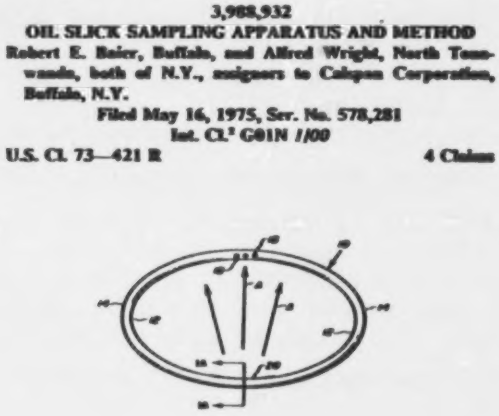
4. SAMPLING

C-1081-77
OIL SLICK SAMPLING APPARATUS AND METHOD
Baier, R. E., and A. Wright. 1976.
U.S. Patent 3,988,932

Sampling, Oil slicks, Surfactants, Design and engineering, Patent

An oil slick sampling method and apparatus is described which consists of surrounding a part of the slick with a large, floating, hoop-like frame, the inner surface of which is coated with a surfactant. This coating spreads outward, thereby compressing the area of the oil slick towards a central region where suitable collecting means are located to sample the slick for analysis.

[from Petroleum Abstracts 17(9):#231,077. 1977]



3,988,932
OIL SLICK SAMPLING APPARATUS AND METHOD
Robert E. Baier, Buffalo, and Alfred Wright, North Tonawanda, both of N.Y., assignors to Calspan Corporation, Buffalo, N.Y.
Filed May 16, 1975, Ser. No. 578,281
Int. Cl.^{2} G01N *1/00*
U.S. Cl. 73—421 R 4 Claims

C-1082-77
MICROBIOLOGICAL STUDIES OF ALTANTIC OCEAN WATER AND SEDIMENT FROM POTENTIAL OFF-SHORE DRILLING SITES
Colwell, R. R., J. D. Walker, B. F. Conrad, and P. A. Seesman. 1976.
Developments in Industrial Microbiology. L. A. Underkofler (ed.) Washington, D.C., American Institute Biological Sciences, 1976. Vol. 17. p. 269-282. Proceedings of General Meeting of the Society for Industrial Microbiology, 32nd, 1975.

Sampling, Microorganisms, Distribution, Seawater, Sediments, Atlantic coast, Offshore drilling, Biological effects

Populations of aerobic, heterotrophic filamentous fungi, yeasts and bacteria, as well as oil-degraders and chitin-hydrolyzers, were isolated from water and sediment samples collected at stations off the southeastern U.S. coast. The microorganisms were enumerated and examined with respect to their role in the microbial ecology of seawater and sediment since this information may prove useful in the future for determining effects of offshore drilling on natural microbial populations.

C-1083-77
DETERMINATION OF THE ATMOSPHERIC CONTRIBUTION OF PETROLEUM HYDROCARBONS TO THE OCEANS
Garrett, W. D., and V. M. Smagin. 1976.
United Nations Environment Programme, WMO-440, SER-6. 37p.

Sampling, Hydrocarbons, Fate, Oceans

Knowledge concerning petroleum hydrocarbons in the marine atmosphere and procedures by which their flux from air to sea may be determined are reviewed. This three phase study included air sampling, sea surface sampling, and the collection of precipitation and dry fallout.

[from Scientific and Technical Aerospace Reports 15(9):#N77-18609. 1977]

C-1084-77
THE HYDROCARBON BURDEN IN THE MARINE ENVIRONMENT SURROUNDING A REFINERY TANKER JETTY
Gump, B. H., H. S. Hertz, W. E. May, and S. N. Chesler. 1977.
Journal of Environmental Science and Health A12(3):105-113.

Sampling, Hydrocarbons, Refineries, Contamination, Sediments, Beaches

Water samples taken from the surface and at 10 m depth and sediment samples taken from a nearby beach were found to have no significant contamination. However, bottom sediments had a low level of contamination of benzo(a)pyrene.

C-1085-77
ASSESSMENT OF HYDROCARBON POLLUTANTS IN GULF AND ESTUARINE ENVIRONMENTS
Lytle, T. F., and J. S. Lytle. 1976.
Journal of the Mississippi Academy of Science 21:128-147.

Sampling, Hydrocarbons, Sediments, OCS, Estuaries, Oil spills, Toxicity, Mississippi, Alabama

Hydrocarbon samples from sediments of the Mississippi-Alabama continental shelf indicate a low level but distinct presence of fossil fuels, in contrast to sediments from offshore Florida which show no evidence of oil pollution. Effects of an oil spill on an estuarine pond were determined experimentally. The sediment was found to act as a trap for the crude oil, and toxic effects on flora and fauna were immediate and intense but relatively short-lived.

[from Petroleum Abstracts 17(12):#231,635. 1977]

C-1086-77
THE INVESTIGATIONS OF THE AIR AND SOIL POLLUTION AROUND THE AREA OF THE PETROLEUM FACTORY IN PLOCK [in Polish]
Siewniak, M. 1975.
Rozpravy Naukowe Akademii Rolniczej w Warszawie No. 53. 93p.

Sampling, Soil, Refineries, Petrochemicals, PAH, Health hazards, *Agriculture, *Poland

Field investigations of air and soil pollution around a refinery-petrochemical plant in Plock, Poland, were conducted with special attention given to the possible effects on agriculture and population. Concentrations of 3,4 benzopyrene near the complex were 15,000 μg/kg soil; at 5 km distance the levels fell to 200 μg/kg. A safety zone in the vicinity of the plant is recommended to reduce the hazards of agricultural contamination.

[from Environmental Health and Pollution Control 11(2):#259. 1977]

C-1087-77
PELAGIC TAR IN THE CARIBBEAN AND EQUATORIAL ATLANTIC, 1974
Sleeter, T. D., B. F. Morris, and J. N. Butler. 1976.
Deep-Sea Research and Oceanographic Abstracts 23(5):467-474.

Sampling, Tar, Caribbean Sea, Atlantic Ocean

Pelagic tar was sampled at 61 stations in the Caribbean and 31 stations in the eastern north and equatorial Atlantic. Tar densities in the Caribbean (1.4 mg/m^2) and Canary Current region (2.0 mg/m^2) were similar to previously recorded densities, but in the equatorial Atlantic densities were significantly lower (0.16 mg/m^2) than others have found. Although the Caribbean has a lower standing stock of tar than the more slowly circulating Sargasso Sea, comparable quantities of tar probably pass through the former in unit time.

[from Oceanic Abstracts 14(1):#77-00646. 1977]

C-1088-77
HYDROCARBON LEVELS IN THE MARINE ENVIRONMENT OF THE SOUTHERN BEAUFORT SEA
Wong, C. S., W. J. Cretney, R. W. MacDonald, and P. Christensen. 1976.
Canada Department of the Environment, Beaufort Sea Project technical report, No. 20. 113p.

Sampling, Hydrocarbons, Chemical analysis, Seawater, Fish, Plankton, Sediments, Sources, Drilling, Natural seepage, Beaufort Sea, *Biogenic hydrocarbons

Hydrocarbon baseline data include sea water, fish, plankton and marine sediments. Sampling techniques, shipboard sample processing, and analytical procedures are discussed. Present levels of aromatic hydrocarbons, low-molecular weight hydrocarbons, nonpolar hydrocarbons, tar, and particulates are extremely low; their levels and compositions are representative of hydrocarbons formed by recent or present marine and terrestrial biosynthesis, inland natural seeps, and onshore drilling.

5. ANALYSIS

C-1089-77
MODEL RELATES CARCINOGENICITY TO STRUCTURE (news brief)
Anon. 1977.
Chemical and Engineering News 55(14):31.

PAH, Carcinogens, Models, *Benzo[a]anthracene

A model to better predict differences in the carcinogenicity of polycyclic aromatic hydrocarbons by their structures is reported. Diol epoxides are produced from polycyclic hydrocarbons through an enzymatic reaction. There is a good correlation between the calculated reactivity of the diol epoxide derivatives and the relative carcinogenicity of the parent hydrocarbon for derivatives of benzo[a]anthracene.

C-1090-77
EXPERIMENTAL INVESTIGATION OF REFINERY EFFLUENTS
Baker, J. M. 1976.
Marine Ecology and Oil Pollution. J. M. Baker (ed.). New York, John Wiley & Sons, 1976. p. 247-254. Institute of Petroleum/ Field Studies Council Meeting, Aviemore, Scotland, 1975.

Wastewaters, Refineries, Analytical techniques, Monitoring, Toxicity

The different types of experiment used for the investigation of refinery effluents are described with examples. Techniques include the settlement plate and transplant experiments useful for monitoring and the further study of effects observed during field surveys, and laboratory tests for the toxicity ranking of effluents. It is difficult to arrange field experiments useful for making predictions about the ecological effects of new effluents in new communities; so monitoring is particularly important in these cases.

C-1091-77

CHARACTERIZATION OF SEDIMENTS IN THE VICINITY OF OFFSHORE PETROLEUM PRODUCTION

Bean, R. M., J. W. Blaylock, E. A. Sutton, R. E. Wildung, and F. M. Davidson. 1974.
Symposium on Chemistry of Marine Sediments. p. 726-735.
Preprint of the Division of Petroleum Chemistry, Inc., American Chemical Society 19(4).

Sediments, Chemical analysis, Offshore production

Summary not available.

[from On Effects of Oil Pollution in Arctic and Subarctic Waters. Seattle, Northwest Marine Fisheries Center. September, 1976]

C-1092-77

MOLECULAR AND ISOTOPIC COMPOSITION OF LIGHT HYDROCARBON GAS IN THE MISSISSIPPI DELTA REGION

Bernard, B. B., J. M. Brooks, and W. M. Sackett. 1976.
American Chemical Society Southwest Regional Meeting, 32nd, Fort Worth, Texas, 1976. p. 38. Abstract.

Hydrocarbons, Chemical analysis, Sampling, Refineries, Petrochemicals, Sources, Gulf of Mexico, *Mississippi Delta

High concentrations of dissolved light hydrocarbons from biogenic and man-derived inputs are present in Mississippi Delta waters. Petroleum refinery and petrochemical plant wastewaters contribute methane containing up to 10% light alkanes, whereas biogenic gases generated in the delta sediments are almost entirely methane and CO_2. The isotopic composition of the methane from the two sources differs significantly. Analyses of samples from various sites in the delta region indicate that man-derived alkanes comprise over 80% of the dissolved hydrocarbons in the river and this component is almost completely masked by biogenic methane in adjacent gulf waters.

C-1093-77

CASE STUDY: CHEMICAL ANALYSES OF SEA AREA POLLUTED BY MINERAL OIL

Carlberg, S. R. 1976.
Second FAO/SIDA Training Course on Marine Pollution in Relation to Protection of Living Resources: Methods for Detection, Measurement and Monitoring of Pollutants in the Aquatic Environment. Rome, UN Food and Agriculture Organization, 1976. p.36-46.

Oil slicks, Chemical analysis, Hydrocarbons, Sweden

Results are discussed of the sampling and analyses of a field of drifting oil detected in January, 1973, outside Varberg, Sweden. Samples revealed nonpolar hydrocarbon concentrations of under 0.05 mg/l.

[from Oceanic Abstracts 14(2):#77-01636. 1977]

C-1094-77
HYDROCARBON STUDIES IN PUGET SOUND AND OFF THE WASHINGTON COAST. REPORT OF PROGRESS, JUNE 1975 - FEBRUARY 1976
Carpenter, R., and A. W. Fairhill. 1976.
Report RLO-2225-T40-1, Contract AT(45-1)-2225-T40. 27p.

Hydrocarbons, Marine organisms, Sediments, Analytical techniques, Chromatography, Spectroscopy, Puget Sound, Washington

Determinations are being made of the types and amounts of aliphatic and aromatic hydrocarbons in organisms, sediments, and waters of the title areas by applying techniques of gas chromatography, high pressure liquid chromatography, UV fluorescence spectroscopy, combined gas chromatography-mass spectrometry, and ^{14}C and $^{13}C/^{12}C$ determinations. This progress report summarizes the first eight months of research.

[from ERDA Energy Research Abstracts 2(2):#3860. 1977]

C-1095-77
EXTRACTION AND IDENTIFICATION OF HYDROCARBONS DISSOLVED IN WATER [English summary]
Chaigneau, M., and M. Chastagnier. 1976.
Bulletin de la Societe Chimique de France Jan-Feb:40-44..

Hydrocarbons, Chemical analysis, Extraction, Solvents, Chromatography, Spectrometry

Solvents effective in extracting hydrocarbons from polluted waters were investigated and compared. Carbon tetrachloride was judged to be superior since it extracted the greatest number of pollutants.

[from Environmental Health and Pollution Control 11(2):#291. 1977]

C-1096-77
THE APPLICATION OF ON-LINE INSTRUMENTATION FOR THE CONTROL OF WATER QUALITY IN THE PETROLEUM INDUSTRY
Condron, J. A., and T. J. Puzniak. 1975.
Analysis Instrumentation Vol. 13. p. 83-86. Instrument Society of America Analysis Instrumentation Symposium, 21st Annual Meeting, Pittsburgh, 1975.

Water quality, Pollution control, Oil industry, Wastewaters, Analytical techniques, Sampling, *On-line instrumentation

The on-line measurements of oil-in-water, pH, and total oxygen demand have been applied to the analysis of waste water within the petroleum industry. Sampling procedures as well as data interpretation play an important role in obtaining full utilization of the analyzer's capabilities.

C-1097-77

DETERMINATION OF TRACES OF OIL IN VARIOUS PRODUCTS BY ADSORPTION POLAROGRAPHY
Epimakhov, V. N., L. I. Kurysheva, and Yu. M. Mishenov. 1976.
Chemistry and Technology of Fuels and Oils 12(1-2):78-79.

Chemical analysis, Wastewaters, Detection, *Oil traces, *Adsorption polarography

Small quantities of oil in the order of 10^{-2} to 10^{-5}% in petroleums, feedstocks, end products, or wastewaters can be determined by a newly developed adsorption polarography technique. Details of the analytical procedure and test results are presented and discussed.

[from The Engineering Index Monthly 15(2):#010383. 1977]

C-1098-77

THE USE OF GC/MS IN THE ANALYSIS OF UNUSUAL ENVIRONMENTAL CHEMICALS
Finnigan, R. E., and J. B. Knight. 1976.
Identification and Analysis of Organic Pollutants in Water.
L. H. Keith (ed.) Michigan, Ann Arbor Science, 1976. p. 185-204.

PAH, Crude oil, Chemical analysis, Chromatography, Spectrometry, Carcinogens

An Alaskan crude oil sample was analyzed using high-resolution capillary column gas chromatography-mass spectrometry to determine if polycyclic aromatic hydrocarbons (PAH) were present in the sample. Benzo(a)pyrene and other known carcinogens were identified by high speed quadrupole mass spectrometry.

C-1099-77

ALIPHATIC HEAVY HYDROCARBON COMPOSITION IN THE BENTHIC MACROEPIFAUNA OF THE SOUTH TEXAS OUTER CONTINENTAL SHELF
Giam, C. S., H. S. Chan, and G. S. Neff. 1976.
American Chemical Society Southwest Regional Meeting, 32nd, Fort Worth, Texas, 1976. p. 38. Abstract.

Hydrocarbons, Benthos, Chemical analysis, Distribution, OCS, Texas, Gulf of Mexico

A program of monitoring heavy hydrocarbon levels and their distribution in the benthic macroepifauna of the title oil exploration areas initially focused on the acquisition of baseline data for the n paraffins (C_{14}-C_{34}). Average concentrations of these hydrocarbons were found to range from 0.06 ppm in shrimp to 2.64 ppm in lizard fish. The n paraffins were identified as characteristically biogenic hydrocarbons.

C-1100-77
A COMPARISON OF METHODS FOR HYDROCARBON ANALYSIS OF MARINE BIOTA
Gritz, R. L., and D. G. Shaw. 1977.
Bulletin of Environmental Contamination and Toxicology 17(4): 408-415.

Hydrocarbons, Chemical analysis, Mollusks, Marine organisms, Chromatography, *Soxhlet extraction, *Saponification

The efficiency of hydrocarbon isolation from clam tissues by Soxhlet extraction was experimentally compared with direct saponification at 2 hour and 24 hour reaction times. The isolated hydrocarbons were fractionated and characterized by column chromatography on fully active columns and on partially deactivated columns. Results presented indicate that 24 hour saponification and partially deactivated column chromatography constitute the best procedure tested.

C-1101-77
ORGANIC CONTAMINANTS OF WATER
Hamilton, C. E. 1976.
ASTM Standardization News 4(1):34-35,49.

Contaminants, Hydrocarbons, Aromatic hydrocarbons, Analytical techniques, *Water pollutants

Available analytical methods for the evaluation of organic pollutants in water, including hydrocarbons, aromatic hydrocarbons, and phenols, are reviewed and compared for sensitivities. Colorimetric methods, UV light absorption and emission, infrared analysis, solvent extraction, activated carbon adsorption, and chromatographic methods are included.

[from Environmental Health and Pollution Control 11(2):#287. 1977]

C-1102-77
HYDROCARBON STATUS IN FLORIDA REAL ESTATE CANALS
Hansen, W. G., G. Bitton, J. L. Fox, and P. L. Brezonik. 1977.
Marine Pollution Bulletin 8(3):57-62.

Hydrocarbons, Sediments, Chemical analysis, Chromatography, Petroleum products, Biodegradation, Bacteria, Coasts, Florida

Hydrocarbon levels in the sediments of real estate canals on the east and west coast of Florida were determined using gas chromatography. Results indicated that the canals on the Gulf of Mexico are receiving an influx of petroleum products. Hydrocarbon degrading bacteria were more abundant than any other bacteria in the sediments of the west coast canals.

C-1103-77

CHARACTERIZATION AND IDENTIFICATION OF OIL SPILLS BY HIGH-SPEED GEL PERMEATION CHROMATOGRAPHY USING AN ULTRAVIOLET ABSORPTION DETECTOR

Higashi, K., and K. Hagihara. 1976.
Bunseki Kagaku 25(11):803-805.

Crude oil, Chemical analysis, Chromatography, Weathering

High-speed gel permeation chromatography was used to determine the molecular weight distribution of eight different kinds of crude oil. Chromatograms of weathered crude oils were similar to unweathered oils.

[from Chemical Abstracts 86(16):#110793u. 1977]

C-1104-77

STUDY OF THE COMPOSITION OF GASOLINE-FRACTION HYDROCARBONS IN WATERS BY CAPILLARY GAS CHROMATOGRAPHY [English summary]

Hrivnak, J., and J. Hassler. 1976.
Vodni Hospodarstvi [Rada] B 26(7):193-195.

Hydrocarbons, Chemical analysis, Chromatography, Wastewaters, *Gasoline fractions

Gasoline-fraction hydrocarbons present in wastewaters were first extracted into a nitrogen stream and isolated by freezing the vapors at -60°C. The resulting isolates were then analyzed by gas chromtography, with a detection sensitivity of 1 ppb.

[from Chemical Abstracts 86(14):#95415b. 1977]

C-1105-77

GRAVIMETRIC DETERMINATION OF PETROLEUM PRODUCTS IN WATER [in Russian]

Ipatov, P. F., E. D. Moskvitina, R. V. Pospelova, and G. I. Rogozhkin. 1975.
Trudy, Vsesoyuznyi Nauchno-Issledovatel'skii Institut Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii 48:13-14.

Petroleum products, Analytical techniques, *Gravimetric determination, Solvents, Extraction

"The petroleum products are extracted with a water-immiscible solvent, and the solvent is evaporated in a water-free atmosphere. The loss in weight of $CHCL_3$, hexane, and ET_2O extracts of kerosene during evaporation is given."

[from Chemical Abstracts 86(18):#126979v. 1977]

C-1106-77
REMOVAL OF PETROLEUM HYDROCARBONS IN ACTIVATED-SLUDGE PLANTS [in German]
Kaspar, H., H. Leidner, and K. Wuhrmann. 1976.
Gas Und Wasserfach 117(9):400-405.

Hydrocarbons, Decomposition, Activated sludge, Chemical analysis, Chromatography

The biochemical decomposition rate of petroleum hydrocarbons was examined using samples of activated sludge containing an emulsion of heating oil. The rate of disappearance of hydrocarbons of different chain length was estimated by gas-liquid chromatography. It was concluded that the detention period in a normal activated-sludge plant is inadequate for complete breakdown of petroleum hydrocarbons absorbed on the sludge.

[from WRC Information 4(2):#77-70102S. 1977]

C-1107-77
IDENTIFICATION AND ANALYSIS OF ORGANIC POLLUTANTS IN WATER
Keith, L. H. (ed.). 1976.
Michigan, Ann Arbor Science, 1976. 718p.

Aromatic hydrocarbons, Carcinogens, Chemical analysis, Contaminants, *Organic pollutants

The identification and analysis of various organic pollutants found in water are reported. Aromatic hydrocarbons and carcinogens are among the substances covered in this collection of papers.

C-1108-77
SOME CHEMICAL PROPERTIES OF SEA SEDIMENTS AS AN INDEX OF THEIR CAPACITY FOR THE SELF-PURIFICATION REMOVAL OF PETROLEUM AND PETROLEUM PRODUCTS [in Russian]
Kiryukhina, L. N., and M. I. Kucherenko. 1975.
Biologicheskoe Samoochishchenie Formirovanie Kachestva Vody, Materialy Vsesoyuznogo Simpoziuma po Sanitarnoi Gidrobiologii 2nd, 1973. M. M. Telitchenko (ed.) Moscow, USSR, "Nauka", 1975. p. 24-26.

Sediments, Chemical analysis, Ports, Oceans, Petroleum products, Contamination, USSR

Physical and chemical parameters were determined for sea sediments from the port of Baku and nearby high seas. An analysis of the chemical-physical properties, and of chloroform-soluble organic substances indicated contamination of the sediments by petroleum and petroleum products.

[from Chemical Abstracts 86(8):#46975a. 1977]

C-1109-77
FINDINGS ON POLYCYCLIC AROMATIC HYDROCARBONS IN WATER [in German]
Kunte, H., and J. Borneff. 1976.
Zeitschrift für Wasser und Abwasser Forschung 9(2):35-38.

PAH, Chemical analysis, Chromatography, Extraction, *Fluorescence

Six fluorescing polycyclic aromatic hydrocarbons (PAH) can be determined in water by extraction from the water with cyclohexane and, after a cleanup on deactivated aluminum oxide, can be separated by two-dimensional thin-layer chromatography (TLC). The substances are identified by their fluorescence and quantification is accomplished directly from the TLC-plate with a scanner or after elution of the substances.

[from Environment Abstracts 7(1):#77-00516. 1977]

C-1110-77
GAS CHROMATOGRAPHIC DETERMINATION OF LOW CONCENTRATIONS OF HYDROCARBONS IN WATER BY VAPOR PHASE EXTRACTION
Mackay, D., W. Y. Shiu, and A. W. Wolkoff. 1975.
American Society for Testing and Materials Special Technical Publication 573. p. 251-258.

Hydrocarbons, Chemical analysis, Chromatography. Design and engineering, *Hydrocarbon measurements

A laboratory apparatus and method are described to determine low dissolved hydrocarbon concentrations and the thermodynamic basis for predicting the fraction of the hydrocarbon partitioning into the vapor phase. Reliable analyses are possible for alkanes down to 10 ppb and for toluene, 75 ppb.

C-1111-77
CLASSIFICATION OF PETROLEUM POLLUTANTS BY LINEAR DISCRIMINANT FUNCTION ANALYSIS OF INFRARED SPECTRAL PATTERNS
Mattson, J. S., C. S. Mattson, M. J. Spencer, and F. W. Spencer. 1977.
Analytical Chemistry 49(3):500-502.

Contaminants, Analytical techniques, Spectrometry, *Pollutant classification, *Computer-spectrometer system

Digitized transmission infrared spectra of six classes of oils were subjected to pattern classification using linear discriminant function analysis. "Several 'decision tree' schemes were tested to develop a high predictive capability ultimately resulting in a 'recognition power' of 97.5%. The highest average probability for class membership comes from the waste crankcase lubricants ($\bar{P}$=0.898) while the lowest average probability not unexpectedly arises from the crude oils ($\bar{P}$=0.838)."

C-1112-77

ON THE DETERMINATION OF PETROLEUM PRODUCTS AND NAPHTHENIC ACIDS DISSOLVED IN SEA WATER

Mazmanidi, N. D., G. I. Kovaleva, and N. A. Zobova. 1976.
Oceanology 15(3):308-311.

Petroleum products, Detection, Seawater, Analytical techniques, *Naphthenic acids

Methodological problems of detecting petroleum products dissolved in seawater are described. Extraction with chloroform and measurement with UV spectrophotometry appears to be an effective combination. The parameters governing the solubility of petroleum products, particularly naphthenic acids, are discussed.

[from Environmental Health and Pollution Control 11(4):#794. 1977]

C-1113-77

ON THE APPLICATION OF RADIOISOTOPE X-RAY FLUORESCENCE ANALYSIS FOR THE SOLUTION OF ENVIRONMENTAL AND INDUSTRIAL PROBLEMS

Meier, H., and E. Unger. 1976.
Journal of Radioanalytical Chemistry 32(2):413-445.

Waste oils, Analytical techniques, Petrochemicals, Industries, *X-ray fluorescence

Equations were given from which methods applicable to environmental analysis and industrial processes could be derived. Methods were suggested which could be useful in analyzing air particles and polluted water. The low mass absorption coefficients of oils qualify them for analysis by this process (engine oils, lubricating oils, fuel oils).

[from Selected Water Resources Abstracts 10(8):#W77-03612. 1977]

C-1114-77

GRAPHICAL METHODS FOR DETERMINING THE CONCENTRATION OF TWO COMPONENTS [English summary]

Mosescu, N., and G. Kalmutchi. 1976.
Revista de Chimie (Bucharest) 27(9):789-790.

Hydrocarbons, Wastewaters, *Spectral absorption characteristics, *Hydrocarbon concentration

A method for determining the concentration of two different hydrocarbons or other compounds in wastewater is described. The method consists of solving a system of 2 equations with 2 unknowns using spectral absorption data of the compounds present.

[from Chemical Abstracts 86(80):#150118j. 1977]

C-1115-77
OPTIMAL OIL TANKER SIZE WITH REGARD TO ENVIRONMENTAL IMPACT OF OIL SPILLS
Sarin, R. K. 1976.
Journal of Environmental Economics and Management 3(3):226-235.

Models, Tankers, Oil spills, Environmental effects, Economics, *Optimal tanker size

A model was developed for assessing the tradeoff between small but frequent spills associated with many small tankers, and relatively less frequent but larger and more concentrated spills associated with smaller fleets of large tankers. A procedure is suggested which incorporates the environmental impacts of oil spills in the model without quantifying them in monetary units. Numerical results relating to optimal tanker size are presented.

[from The Engineering Index Monthly 15(3):#020764. 1977]

C-1116-77
ORGANIC SUBSTANCES IN THE COASTAL WATERS OF THE DDR. I. RESULTS OF ELIMINATION ANALYSIS
Schlungbaum, and G. V. Vobach. 1976.
Limnologica 10(2):437-451.

Contaminants, Analytical techniques, Hydrocarbons, Coasts, East Germany, *Spectrophotometry, *Colorimetry

Spectrophotometric and colorimetric procedures were used to measure the presence of organic pollutants in coastal waters of East Germany. Hydrocarbons were found to be among these substances.

[from Chemical Abstracts 86(16):#1109702. 1977]

C-1117-77
POLYCYCLIC AROMATIC HYDROCARBONS IN LAKE WATERS AND ASSOCIATED SEDIMENTS: ANALYTICAL DETERMINATION BY GAS CHROMATOGRAPHY-MASS SPECTROMETRY
Strosher, M. T., and G. W. Hodgson. 1975.
American Society for Testing and Materials, STP 573. p. 259-270.

PAH, Lakes, Sediments, Analytical techniques, Chromatography, Spectrometry

Summary not available.

[from University of Calgary Environmental Sciences Centre Log of 1975 Reports and Publications. No.75-4. 1976]

C-1118-77
PETROLEUM HYDROCARBONS FROM EFFLUENTS: DETECTION IN MARINE ENVIRONMENT
Tanacredi, J. T. 1977.
Journal Water Pollution Control Federation 49(2):216-227.

Wastewaters, Detection, Hydrocarbons, Crankcase oil, Chemical analysis, Marine organisms, New York

Weekly samples from four wastewater treatment facilities discharging into Jamaica Bay, New York, were analyzed for the presence of waste crankcase petroleum products. Gas chromatography and two novel ultra-violet fluorescence spectroscopy techniques were used in the analyses. Heavy hydrocarbon pollution attributable largely to automotive wastes was detected in the bay's surface waters and in tissues of the benthic organism, Mya arenaria.

C-1119-77
CHARACTERISTICS OF WORLD'S CRUDE OILS AND RESULTS OF API RESEARCH PROJECT 60
Thompson, C. J., C. C. Ward, and J. S. Ball. 1976.
ERDA report, BERC/RI-76/8. 32p.

Crude oil, Chemical analysis, Source identification, API

This report contains information about the Energy Research and Development Administration (ERDA) method for routine crude oil analysis and its application to representative crudes throughout the world. Presented are compositional data on Ponca City, Oklahoma crude oil - an oil studied extensively by API Research Project 6 - and a summary of the present knowledge of sulfur-, nitrogen-, oxygen-, and metal-containing materials in petroleum. [from ERDA Energy Research Abstracts 2(1):#155. 1977]

C-1120-77
CONTINUOUS FLOW APPARATUS FOR USE IN PETROLEUM BIOASSAY
Vanderhorst, J. R., C. I. Gibson, L. J. Moore, and P. Wilkinson. 1977.
Bulletin of Environmental Contamination and Toxicology 17(5): 557-584.

Hydrocarbons, Dispersions, Design and engineering, *Petroleum bioassay, *Continuous flow system

The purpose of the study was to develop a system capable of producing stable concentrations of dispersed petroleum hydrocarbons in seawater so that long-term bioassay experiments could be carried out under uniform conditions. Such a system is described herein along with test results using No. 2 fuel oil. A discussion of problems encountered and possible applications of the system to crude oils is included.

C-1121-77
SYNCHRONOUS FLUORESCENCE SPECTROSCOPY AND ITS APPLICATION TO INDIGENOUS AND PETROLEUM-DERIVED HYDROCARBONS IN LACUSTRINE SEDIMENTS
Wakeham, S. G. 1977.
Environmental Science and Technology 11(3):272-276.

Aromatic hydrocarbons, Analytical techniques, Chromatography, Spectroscopy, Sediments, Lakes, *Fluorescence

By separating the aromatic hydrocarbon fractions using liquid-solid column chromatography prior to fluorescence analysis, greater information on the aromatic content of the oils is obtained. The synchronous method is compared with conventional fluorescence spectroscopy and is used to characterize the indigenous and petroleum derived aromatic hydrocarbons in sediments of Lake Washington.

C-1122-77
ANALYSIS OF OIL SPILL TRENDS
Young, G. K., D. Evans, and R. U. Jettmar. 1976.
Final report, Contract EQ6AC014. 50p.

Spill cleanup, U.S., Statistical analysis, USCG, EPA, Information systems

National trends of oil spills and their cleanup have been derived from an analysis of 1972 through 1975 data compiled in the U.S. Coast Guard Pollution Incident Reporting System (PIRS) and the Spill Prevention, Control and Countermeasure (SPCC) file of the Environmental Protection Agency.

[from Government Reports Announcements 77(5):#PB-260 917/OGA. 1977]

6. SOURCE IDENTIFICATION

C-1123-77
CHARACTERIZATION OF AUSTRALIAN CRUDES AND CONDENSATES BY GAS CHROMATOGRAPHIC ANALYSIS. COMMENTS
Adlard, E. R. 1976.
Environmental Science and Technology 10(3):284.

Source identification, Crude oil, Hydrocarbons, Chemical analysis, Chromatography

A technique useful in identifying oil pollution sources was developed, based on the measurement of the non-weathered and nonvoltile C_{12-20} hydrocarbons present in crude oil. These fractions are analyzed and quantified by gas chromatography. Four examples of pollutant source identification in Australian waters are discussed.

[from Chemical Abstracts 86(12):#75550p. 1977]

C-1124-77
IDENTIFYING OIL IN THE ENVIRONMENT BY INFRARED SPECTROSCOPY
Brown, C. W. 1975.
Preprints of Papers Presented at National Meeting, Division of Environmental Chemistry, American Chemical Society 15(1):191-193.

Source identification, Oil spills, Chemical analysis, Spectroscopy, Seawater

The unique IR fingerprints of over 300 different oils were digitized and stored in computer files for possible comparison in case of future unidentified oil spillages. Spectral changes in the signatures of weathered oils have been correlated, and IR spectroscopy has been used to determine the relative amounts and types of hydrocarbons present in seawater.

[from Chemical Abstracts 86(12):#75568a. 1977]

C-1125-77
TOTAL LUMINESCENCE CONTOUR SPECTRA OF SIX TOPPED CRUDE OILS
Chisholm, B. R., H. G. Eldering, L. P. Giering, and A. W. Hornig. 1976.
Contract PO-BE-76-P-1221. 48p.

Source identification, Crude oil, Analytical techniques, *Luminescence contour spectra

"The results of a preliminary study of six topped crude oils by total luminescence are presented. Included are six contour spectra, six principal excitation/emission spectra, an interpretation of the contours by comparison with other data, a discussion of the method and recommendations for further related studies. These data are used in oil spill identification."

[from ERDA Energy Research Abstracts 2(9):#21645. 1977]

C-1126-77
ON THE ORIGIN OF POLYCYCLIC AROMATIC HYDROCARBONS IN THE AQUEOUS ENVIRONMENT
Hase, A., and R. A. Hites. 1976.
Identification and Analysis of Organic Pollutants in Water
L. H. Keith, (ed.). Michigan, Ann Arbor Science, 1976. p. 205-214.

Source identification, PAH, Sources, Chemical analysis, Chromatography, Spectrometry, Sediments, *Aquatic environment

Different sources of PAH in the aqueous environment, including sediments, were investigated and analyzed using high-resolution gas chromatography-mass spectrometry. Results indicated the main source of PAH to be anthropogenic, airborne, and combustion produced.

C-1127-77
IDENTIFICATION OF CRUDE OILS BY LUMINESCENCE TECHNIQUES
John, P. and I. Soutar. 1976.
Proceedings of the Analytical Division of the Chemical Society (London) 13(10):309-310.

Source identification, Crude oil, Chemical analysis, *Fluorometry

Synchronous excitation fluorometry was used to rapidly characterize crude oils and was found to be especially useful in identifying the source of oil pollution.

[from Chemical Abstracts 86(16):#108919w. 1977]

C-1128-77
MULTIVARIATE STATISTICAL APPROACH TO THE FINGERPRINTING OF OILS BY INFRARED SPECTROMETRY
Mattson, J. S., C. S. Mattson, M. J. Spencer, and S. A. Storks. 1977.
Analytical Chemistry 49(2):297-302.

Source identification, Statistical analysis, Analytical techniques, Spectrometry

"The need to attach a statistically significant number, describing the extent of match or mismatch of infrared spectra of oil samples, is satisfied using a multivariate normal probability density function. The requirements of normality and independence are examined, and two methods of baseline placement are considered. Example results are presented for a test population of 10 lubricating oils, 22 waste lubes, 30 No. 2, 30 diesel, 12 No. 4, 10 No. 5, 28 No. 6 fuels, and 62 crude oils."

C-1129-77
SOURCES OF TAR POLLUTION ON ISRAELI MEDITERRANEAN COAST
Shekel, Y., and R. Ravid. 1977.
Environmental Science and Technology 11(5):502-505.

Source identification, Tar balls, Analysis, Chromatography, Sampling, Crude oil, Weathering, Israel, Mediterranean Sea

A 1 1/2 year tar ball sampling program was conducted along Israel's Mediterranean coast to determine the types and sources of oil pollution. Chromatographic analysis indicated that 76% of the tar balls were formed from crude oil and crude oil sludge, 18% from weathered fuel oil, and 4% from greatly weathered oil. Vanadium-nickel ratios and sulfur content studies established that 96% of the tar balls from crude oils were from Middle Eastern sources. Of this 96%, 46% were weathered about 2 weeks, 41% over 2 months, and 13% were probably weathered 1-2 years.

C-1130-77
CRUDE OIL SPILLS RESEARCH. AN INVESTIGATION AND EVALUATION OF ANALYTICAL TECHNIQUES
Wilson, C. A., E. P. Ferrero, and H. J. Coleman. 1975.
Report BM-RI-8024.

Source identification, Oil spills, Crude oil, Analytical techniques, Chromatography, Spectroscopy, Spectrometry, *U.S. Bureau of Mines

The article describes the program of the U.S. Bureau of Mines to investigate and evaluate analytical techniques for the simple, rapid and reliable identification of crude oil spills. Analytical techniques studied include: gas-liquid chromatography, atomic adsorption spectrophotometry, infrared spectroscopy, sulfur and nitrogen determinations, mass spectrometry, nuclear magnetic resonance spectroscopy and ultraviolet spectrophotometry.

[from ERDA Energy Research Abstracts 2(7):#15793. 1977]

C-1131-77
POLYCYCLIC AROMATIC HYDROCARBONS IN THE ENVIRONMENT: HOMOLOGOUS SERIES IN SOILS AND RECENT MARINE SEDIMENTS
Youngblood, W. W., and M. Blumer. 1975.
Geochimica et Cosmochimica Acta :1303-1314.

Source identification, PAH, Hydrocarbons, Sediments, Soils, Crude oil, Petroleum products

Soils, marsh sediments, subtidal sediments, ancient sedimentary rocks, crude oil and petroleum products, and wood tar were sampled and analyzed by mass spectrometry for their polycylic aromatic hydrocarbon (PAH) assemblages. Molecular weight distribution patterns of PAH fractions in crude oils, refined oils, oil shales and ancient sediments were found to be similar. Likewise, soils and recent sediments were found to contain a distinct series of alkylated PAH homologs of similar molecular weight distribution. It is suggested that the hydrocarbons of recent sediments are formed in natural fires and are atmospherically dispersed and deposited.

B. OIL POLLUTION PREVENTION AND CONTROL

1. CONTAINMENT

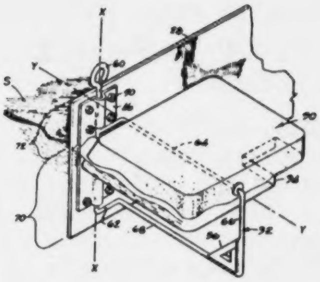
C-1132-77
CONTAINMENT BOOM
Casey, G. J. 1976.
U.S. Patent 3,973,406

Spill containment, Booms, Design and engineering, Patent

An elongated curtain-like partition barrier is described that is supported in a vertical position in the water by outrigger-type flotation units and is flexible enough to encircle an oil spill or oil tanker. The boom is impervious and can be folded accordion fashion for compact storage and transport.

[from Selected Water Resources Abstracts 10(4):#W77-01721. 1977]

3,973,406
CONTAINMENT BOOM
Gerald J. Casey, 1819 Curtis St., Berkeley, Calif. 94702
Filed Dec. 26, 1974, Ser. No. 536,348
Int. Cl.^{2} E02B *3/00*
U.S. Cl. 61—1 F **9 Claims**



C-1133-77
ANTI-POLLUTION BARRIER AT THE SURFACE OF THE WATER
(Granges Essem Plast A/S). 1976.
French Patent 2,301,638

Spill containment, Booms, Design and engineering, Patent

A submersible floating barrier for the containment of oil spills and floating debris is described. The barrier is equipped with floats which support a removable, flexible membrane in such a way that it can move upward and downward in the water column.

[from Petroleum Abstracts 17(15):#232,313. 1977]

C-1134-77
ON THE USE OF AIR-BUBBLE SCREENS AS OIL BARRIERS
Kobus, H. E. 1975.
Fundamental Tools to be Used in Environmental Problems. International Association for Hydraulic Research, 16th Congress, University of Sao Paulo, Brazil, 1975. Vol. 3 - Subject C. Hydro. Aspects in Environmental and Ecological Enhancement. p.356-363.

Spill containment, *Air bubble screens

From experiments of the flow field induced by an air-bubble screen, the resulting surface current can be predicted as a function of water depth, and air can be predicted as a function of water depth and air discharge, both in a standing water body and in a cross current. This information about flow fields leads to a design procedure for pneumatic oil barriers.

[from MRIS Abstracts 14:#14139883. 1977]

C-1135-77
TANKERS COULD CARRY OWN OIL BOOMS (news brief)
Lucander, N. 1977.
Western Fisheries 94(1):52-53.

Spill containment, Tankers, Booms, Design and engineering

It is the author's opinion that all tankers should be fitted with their own oil spill booms stored around the gunwhale with a length twice as long as the perimeter of the ship. Any leaking oil from the holds would be contained in the area and readily recovered with existing recovery equipment. The "Lucan" Bottom Tension Oil Spill Control Boom features are outlined.

C-1136-77
FENDING DEVICE FOR OIL CONTAINMENT BOOM
Nielsen, E. C. 1977.
U.S. Patent 4,000,532

Spill containment, Booms, Design and engineering, Patent, *Fending device

"A barrier is breasted away from a vessel and other structures by a floating, open structure with vertical fenders extending above and below the water line. The device is composed of an open planar fending structure of high strength/weight ratio."

[from Petroleum Abstracts 17(18):#233,093. 1977]

C-1137-77
PETRO TRAP (product information)
PENCO Division, Hudson Engineering Company. n.d.
PENCO Division, Hudson Engineering Company, 1114 Clinton St.,
Hoboken, NJ 07030.

Spill containment, Spill recovery, Absorption, *Sorbent pads

Petro Traps are sorbent pads made of oleophilic polymeric foam enclosed in watertight (hydrophobic) spunbonded polypropylene jackets. Each pad weighs about 454 g (1 lb) and absorbs about 15 l (nearly 4 gal) of oil. The pads can be connected to form containment booms or stacked to form barriers.

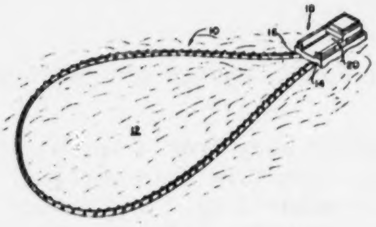
C-1138-77
BARRIER FOR WATER CARRIED POLLUTANTS
Preus, P. 1976.
U.S. Patent 3,998,060

Spill containment, Booms, Design and engineering, Absorption, Hydrocarbons, Patent

The barrier consists of a series of end-to-end connectable boom sections made of an oleophilic-hydrophobic composition which selectively absorbs hydrocarbons. The apparatus has fluid impervious connectors for the ends of the boom sections and flexible draft members.

[from Petroleum Abstracts 17(16):#232,470. 1977]

3,998,060
BARRIER FOR WATER CARRIED POLLUTANTS
Paul Preus, Smith Road, Toms River, N.J. 08753
Filed Apr. 14, 1976, Ser. No. 676,794
Int. Cl.^{2} E02B *15/04*; B63B *35/00*
U.S. Cl. 61—1 F **6 Claims**



C-1139-77

BARRIER FOR FIGHTING THE POLLUTION OF WATER BY HYDROCARBONS
(Rhine & Rhone, SA.) 1976
French Patent 2,289,682

Spill containment, Booms, Adsorption, Hydrocarbons, Design and engineering, Patent

An adsorption and containment boom is described which is made of a fixed mesh weave that permits the passage of water but retains hydrocarbons by adsorption. A ballasted skirt keeps the barrier perpendicular to the flow of the water.

[from Petroleum Abstracts 17(12):#231,634. 1977]

C-1140-77

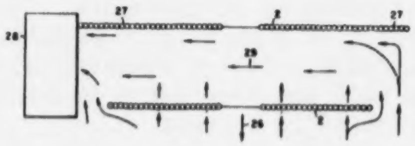
OIL BOOM AND METHOD OF SKIMMING FLOATING OIL FROM THE SURFACE OF A BODY OF WATER
Veld, C. 1976.
U.S. Patent 3,979,291

Spill cleanup, Booms, Skimmers, Oil slicks, Design and engineering, Patent

An oil boom assembly for collecting oil from the surface of a body of water is described. The unit consists of parallel rows of vertical, buoyant barrier screen members connected by flexible means and rigidly braced to hold the members upright in the water. The progressive length of the rows permits flow of surface water around the shorter barriers and towards the skimmer.

[from Selected Water Resources Abstracts 10(4):#W77-01759. 1977]

3,979,291
OIL BOOM AND METHOD OF SKIMMING FLOATING OIL FROM THE SURFACE OF A BODY OF WATER
Cornelis in 't Veld, Vlaardingen, Netherlands, assignor to National Marine Service, Inc., St. Louis, Mo.
Continuation of Ser. No. 422,603, Dec. 6, 1973, abandoned. This application May 30, 1975, Ser. No. 582,271
Claims priority, application Netherlands, Dec. 7, 1972, 7216633
Int. Cl.^{2} E02B *15/04*
U.S. Cl. 210—84 **13 Claims**



2. CLEANUP AND RECOVERY

C-1141-77
No title given (product information)
Anon. 1977.
Chemical and Engineering News 55(14):20.

Spill recovery, Adsorption, Design and engineering, *Ferromagnetic foam

The Florida Sea Grant Program and Gulf-Tampa Drydocks have developed a prototype oil spill recovery boat equipped with pontoons that funnel oil between the hulls where it is absorbed by a layer of ferromagnetic foam. The maximum recovery rate is expected to be about 16,800 l/km/hr (2400 gal/knot).

C-1142-77
ARCTIC SUBSEA BLOWOUT BURNING FEASIBILITY STUDY MADE IN CANADA (news brief)
Anon. 1977.
Sea Technology 18(3):38.

Oil wells, *Blowouts, Spill disposal, Incineration, Ice, Arctic, Canada

Oil or gas well blow-outs in the Arctic environment are being studied by Arctec Canada, Ltd.; burning of the oil or gas in-situ appears to be the most efficient technique of disposal. A feasibility study for igniting oil on Arctic ice is in progress and recommendations will be based on reliability of ignition, cost, ease of deployment, and toxicity.

C-1143-77
ASIATIC PETROLEUM BUYS SECOND OIL SKIMMER (news brief)
Anon. 1977.
Sea Technology 13(5):37.

Spill cleanup, Spill recovery, Skimmers, *Strait of Malacca

A second SPILTROL harbor oil skimmer has recently been purchased and will be utilized for oil spill cleanup in the Strait of Malacca; the first one is standing by in Singapore. The skimmer vessel recovers oil at speeds of 3 km/hr (1.6 knots), sweeping a path about 6 m (20 feet) wide. Oil is funneled through a baffle arrangement in the hull and from there is pumped into onboard tanks with a capacity of 28 barrels.

C-1144-77
INLAND AND OFFSHORE
Anon. 1976.
Marine Engineering/Log 81(11):104,106,106B,106F,106H.

Spill recovery, Design and engineering

A new Class 1 oil spill recovery vessel built by Marine Construction and Design Co. attained speeds of 37 km/hr (20 kn) in responding to an oil spill. It is fitted with a portable 1900 1 (500 gal) storage tank for recovered oil, off-loading pumps, fire hoses, trash handling equipment, and space to carry floating booms to contain or divert oil spills in small bays and around industrial sites.

[from Oceanic Abstracts 14(2):#77-01884. 1977]

C-1145-77
A MOP FOR OIL OR PREVENTER OF SPILLS? (news brief)
Anon. 1977.
Massachusetts Audubon 16(6):9.

Spill cleanup, Pollution prevention, Safety, Regulations, USCG

The role of the U.S. Coast Guard in the cleanup and prevention of oil spills is discussed and current safety standards as required by the 1972 Ports and Waterways Safety Act are reviewed.

C-1146-77
A NEW MODEL CLEANUP SWEEP OIL SKIMMER FOR USE IN RECOVERING SPILLED OIL (news brief)
Anon. 1977.
Chemical & Engineering News 55(17):21.

Spill recovery, Skimmers, *Clean Sweep oil skimmer

The new model Clean Sweep oil skimmer developed by Lockheed is designed with a hollow center enclosing a container filled with closed-cell foam to assure buoyancy. This modification makes it possible to recover spilled oil in 1.5 m (5 ft) seas and 1.6 km/hr (1 knot) currents.

C-1147-77
NORWEGIANS TAKE STEPS IN PREPARATION FOR POSSIBLE NORTH SEA DISASTERS, SPILLS
Anon. 1977.
Offshore 38(5):303-306.

Spill cleanup, Environmental protection, Offshore development, Safety, Economics, North Sea, Norway

Environmental and safety risks of developing North Sea oil fields are discussed, and the possible economic consequences of a large blowout are weighed against the value of the offshore oil. Norwegian requirements for mechanical spill cleanup and recovery equipment to be used in the North Sea are outlined; such equipment should be able to function in 2-3 m waves, wind speeds of 10-11/sec, and currents of 2.7 km/hr (1.5 knots).

C-1148-77
OIL SKIMMING SYSTEM (product information)
Anon. 1977.
Chemical Engineering 84(11):122.

Spill recovery, Waste oil, Fuels, Oil-water separation, Skimmers, Design and engineering

A floating skimmer system has been designed for removing oils, fuels, and oily wastes from water surfaces. The device is adjustably ballasted, and an inner tank that retains the skimmed oil permits cleaning of the oil while it is floated on brine. The brine pushes the oil up to a fixed level inlet through which it is pumped to a storage facility.

C-1149-77
OIL SPILL CLEARANCE COMBINE (news brief)
Anon. 1977.
Marine Pollution Bulletin 8(4):77.

Spill cleanup, Booms, Skimmers, *Vikoma International

Vikoma International Ltd. has been established by BP and Vickers Ltd. to market oil spill clearance equipment including the Vikoma Seapack boom system, the Vikoma Seaskimmer and Komara miniskimmer. The Vikoma systems are currently available in six continents for emergency use in spill situations and have been successfully used in several major accidents.

C-1150-77
OIL SPILL DISPERSANT FOR MARINE POLLUTION
Anon. 1974.
South African Bureau of Standards - Bulletin 4(4):68-72.

Dispersants, Spill cleanup, Toxicity, Marine organisms, South Africa

Specifications for an oil spill dispersant for use in cleaning up crude and fuel oil spills on water and beaches are given by the South African Bureau of Standards. Requirements of dispersion efficiency, toxicity to marine life, consistency, and corrosiveness are described and the compatibility of the dispersant with other dispersants is discussed.

[from Selected Water Resources Abstracts 10(3):#W77-01387. 1977]

C-1151-77
A REMEDY FOR OIL SPILLS
Anon. 1977.
Compressed Air 82(2):15-18.

Spill cleanup, Skimmers, Design and engineering, *Dynamic Inclined Plane skimmer

The Dynamic Inclined Plane skimmer (DIP) developed by JBF Scientific Corporation is described. The DIP is able to skim oil and floating debris. The process involves collecting oil by forcing it down under the water surface and along an inclined plane into a collection well where the oil forms a deep oil pocket suitable for pumping to a storage facility.

[from Pollution Abstracts 8(3):#77-02547. 1977]

C-1152-77
THE WORLD'S MOST POWERFUL TUG
Anon. 1976.
Marine Engineers Review p.45-46.

*Salvage tug, Pollution control, Spill cleanup, Design and engineering, South Africa

The new salvage tug "S.A. Wolraad Woltemade" was designed by Robb Caledon Shipbuilders and is owned by the South African Marine Corporation. Its role includes pollution control operations at sea, fire fighting, salvage, rescue, and long range ocean towage. The design of the tug and the equipment on board are described.

[from Oceanic Abstracts 14(1):#77-00901. 1977]

C-1153-77
WOLRAAD WOLTEMADE: SALVAGE TUG
Anon. 1976.
Ship & Boat International 29(7-8):23-26.

*Salvage tug, Pollution control, Spill cleanup, Design and engineering, South Africa

The single-screw, long-range salvage tug is considered the largest, fastest, and most powerful salvage tug yet built. It can maintain four divers with underwater welding equipment and car tow over any distance. The vessel has fire-fighting equipment and oil pollution cleanup agents. The tug was built by Robb Caledon Shipbuilders, Scotland, and is owned by the South African Marine Corporation.

[from Oceanic Abstracts 14(1):#77-00874. 1977]

C-1154-77
ZERO-RELATIVE-VELOCITY OIL SKIMMER (product information)
Anon. 1977.
Petroleum Engineer International 49(3):11-12,14.

Skimmers, Spill recovery, Absorption, Design and engineering

A 12 m (40 ft) prototype oil skimming vessel uses twin sorbent belts to recover up to 2272 l/m (600 gpm) of spilled oil in 11 to 14 km/hr (6 to 8 knot) currents. Developed by Shell Development Co., the device utilizes the principle that if no appreciable velocity exists between an oil layer and the removal device, no major turbulence results and entrained oil droplets will not form. Dimension and performance specifications are given and oil recovery rates are discussed.

C-1155-77
SYSTEM FOR RECOVERING PETROLEUM FLUIDS FROM UNDERWATER FISSURES
ARCADIA REFINING COMPANY. 1976.
U.S. Patent 3,981,154

Spill recovery, Design and engineering, Patent, Underwater fissures

A method for recovering fluids lighter than water escaping from an underwater fissure is described. Escaping fluid rises through an open-bottomed tank positioned vertically above the fissure and displaces the water previously in the tank. The tank is anchored to maintain a fixed position as the buoyancy of the recovered fluid is gained.

[from Underwater Information Bulletin 9(2):#77/04/24. 1977]

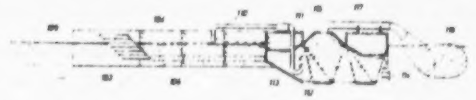
C-1156-77
OIL SPILL CLEANUP SYSTEM
Ayers, R. R. 1976.
U.S. Patent 3,966,614

Spill recovery, Design and engineering, Patent

An apparatus for removing oil from the surface of a body of water consists of a support balance, a compartment and baffles to allow entry of the oily water into chambers, and a wave conformable articulating bottom.

[from Official Gazette of the United States Patent and Trademark Office 947(5):2251. 1976]

3,966,614
OIL SPILL CLEANUP SYSTEM
Ray R. Ayers, Houston, Tex., assignor to Shell Oil Company, Houston, Tex.
Continuation of Ser. No. 292,028, Sept. 25, 1972, abandoned, which is a continuation-in-part of Ser. No. 225,987, Feb. 14, 1972, abandoned. This application July 29, 1974, Ser. No. 492,556
Int. Cl.^{2} E02B *15/04*
U.S. Cl. 210—242 R **14 Claims**



C-1157-77
GELATION OF OIL SLICKS BY AMINE CARBAMATES AS AN ADJUNCT TO U.S. NAVY OIL SPILL RECOVERY OPERATIONS
Bannister, W. W. 1977.
Final report, Contract N00014-76-C-0340. 79p.

Spill recovery, Oil slicks, Pollution prevention, USN, *Gelation, *Amine carbamates

Solutions of Amine D in ethyl and benzyl alcohol, when sprayed on oil slicks to a concentration of 10% and then treated with CO_2 to form the carbamate, provide excellent gelation of the oil. Tests were performed on gel strengths and on effects of film thickness, temperature, and salinity for various fuels. A field test indicated this system is very advantageous in oil slick recovery. The toxicity of the Amine D is of a very low order, comparable to that of the oil slick itself.

[from Government Reports Announcements 77(9):#AD-A035 702/OGA. 1977]

C-1158-77
FLOATING APPARATUS FOR TREATING THE UPPER LAYER OF A LIQUID MASS
(B. J. Consultant Sarl). 1976.
French Patent 2,306,123.

Spill cleanup, Skimmers, Design and engineering, Patent

A floating apparatus for cleaning up oil spills is described. The apparatus has a vertically adjustable intake and a large central tank with horizontal baffles that divide it into superposed decantation chambers. The stern end of the tank has outflow pipes for purified water, and suction pumps remove the oil and send it to storage tanks located laterally from the main tank.

[from Petroleum Abstracts 17(15):#232,317. 1977]

C-1159-77
DETERGENT COMPOSITION FOR DISPERSING OIL SPILLS
Blanchard, P. M., and D. G. Meeks. 1976.
U.S. Patent 3,998,733

Spill cleanup, Emulsions, Surfactants, Dispersants, Patent

The detergent composition is sprayed onto the oil to form an oil-water emulsion. The emulsion is diluted in the water and the spilled material is dispersed as very fine droplets. This reduces its effect on the marine environment and assists its biodegradation.

[from Petroleum Abstracts 17(16):#232,469. 1977]

C-1160-77
HARMLESS DISPOSAL OF MINERAL OIL
Boelsing, F. 1976.
German Offenlegungsschriften (unexamined patent application)
2,520,999.

Spill disposal, Soil, Biodegradation, Microorganisms, Patent

Alkaline earth oxides are combined with oil spilled on land to form a loose powder that can be biodegraded by soil microorganisms. Thus, a field contaminated by a crude oil spill was treated with lime, and after several months the field was successfully used to grow potatoes.

[from Chemical Abstracts 86(18):#126802g. 1977]

C-1161-77
PORTABLE PUMPS FOR OIL TRANSFER CLEANSING AND SPILLAGE RECOVERY
Burton, J. D. 1975.
Pumps Pompes Pumpen No.111:1015-1018.

Oil transfer, Spill recovery, *Portable pumps

The various duties and requirements for small to medium size portable pumps used for cleanup in oil transfer and oil spill recovery are discussed.

[from Environmental Health and Pollution Control 11(4):#885. 1977]

C-1162-77
THE SEPARATION OF OIL FROM WATER FOR NORTH SEA OIL OPERATIONS
Central Unit on Environmental Pollution (England). 1976.
London, Her Majesty's Stationery Office, 1976. v + 29p.
(Pollution Paper No. 6)

Offshore development, Oil-water separation, North Sea

Summary not available.

[from Environmental Conservation 4(1):80. 1977]

C-1163-77
HOW BRITAIN HANDLES OIL SPILLS (news brief)
Cormack, D. 1977.
Petroleum Engineer International 49(5):14-15.

Spill cleanup, Dispersants, Toxicity, England

The use of oil spill dispersants in Britain is briefly discussed. The Warren Spring Laboratory dispersant spraying equipment was developed to effectively disperse oil throughout the water column and prevent contamination. Results of experiments on dispersant treated oil slicks show that concentrations of dispersed oil in the water column are low and of short duration in comparison with levels and times required to bring about toxic effects in the laboratory.

C-1164-77
ACCIDENTAL OIL POLLUTION OF THE SEA: A REPORT BY OFFICIALS ON OIL SPILLS AND CLEANUP MEASURES
Department of Environmental Pollution, UK. 1976.
London, Her Majesty's Stationery Office, 1976. 169p.
(Pollution Paper No. 8)

Spill cleanup, Oceans

Summary not available.

[from Applied Ecology Abstracts 3(2):#3D1766. 1977]

C-1165-77
A CONTROLLABLE SORBENT BROADCASTER
Der, J. J. 1976.
U.S. Patent Application AD-D003 269/8.

Spill recovery, Absorption, Design and engineering, Patent, *Sorbent broadcaster

An apparatus is described which can effectively broadcast oil absorbent material over an oil slick at a controlled rate. The device consists of a rotating cylinder of wire mesh connected to an endless belt with compartments that are filled with the sorbent materials. The material is uniformly distributed from the endless belt into the rotating wire mesh cylinder, from which it is broadcast over the drop area.

[from Government Reports Announcements 77(7):#PAT-APPL-716 916/GA. 1977]

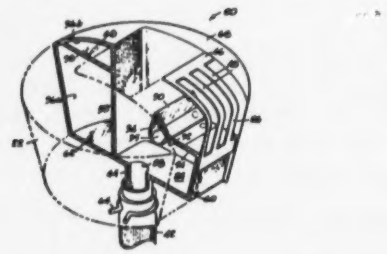
C-1166-77
FLOATING SKIMMER FOR CLEANING THE SURFACE OF A BODY OF LIQUID, METHOD AND APPARATUS
Gore, D. J. 1976.
U.S. Patent 3,970,556

Spill recovery, Skimmers, Contaminants, Design and engineering, Patent

A manually controlled skimmer for cleaning and removing contaminants from the water surface is described and the operation of the movable weir is discussed in reference to the surface tension of the water.

[from Selected Water Resources Abstracts 10(3):#W77-01228. 1977]

3,970,556
FLOATING SKIMMER FOR CLEANING THE SURFACE OF A BODY OF LIQUID, METHOD AND APPARATUS
Douglas John Gore, 5168 Brookside Lane, Concord, Calif. 94521
Filed Sept. 23, 1974, Ser. No. 508,446
Int. Cl.² B01D *21/00*; E02B *15/04*
U.S. Cl. 210—83 **20 Claims**



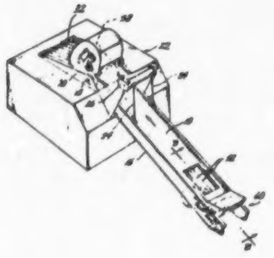
C-1167-77
MOVING BELT-TYPE OIL SKIMMER WITH PROPULSION INDUCED FLOW, METHOD AND APPARATUS
Grimes, E. L., and D. W. Lerch. 1976.
U.S. Patent 3,992,292

Spill recovery, Skimmers, Design and engineering, Patent

"An oil spill recovery method and apparatus employs a low-resistance flow-through endless belt of reticular oleophilic hydrophobic material. Water with oil is force-flowed through the belt through induction effected by propulsion means operating at a position immediately behind and beneath the submerged active portion of the belt."

[from Petroleum Abstracts 17(9):#231,087. 1977]

3,992,292
MOVING BELT-TYPE OIL SKIMMER WITH PROPULSION INDUCED FLOW, METHOD AND APPARATUS
Eldon L. Grimes, and David W. Lerch, both of Seattle, Wash., assignors to Marine Construction & Design Co., Seattle, Wash.
Filed Oct. 15, 1974, Ser. No. 514,814
Int. Cl.^{2} B01D *15/06*; E02B *15/04*
U.S. Cl. 210—30 A **9 Claims**



C-1168-77
OIL SPILL CLEANUP USING A COTTON SORBENT
Halligan, J. E., A. A. Ball, and G. F. Meenaghan. 1976.
Final report, USCG-D-63-76; Contract DOT-CG-42557-A. 144p.

Spill cleanup, Absorption, Disposal, *Cotton sorbent

A sorbent dispersal, retrieval, and disposal system was developed, using cotton wastes, to combat oil pollution. It is concluded from the test program that the use of cotton as an oil spill cleanup agent is viable and that the system was able to retrieve about 95% of the oil confronted for water velocities of 0.6 m/sec (2 ft/sec) or less and dispersion ratios of 22.7 + g (0.05 + lbs) of cotton per 454 g (1 lb) of oil.

[from Government Reports Announcements 77(8):AD-A034-955/5GA. 1977]

C-1169-77

OELA-III SWISS OIL SKIMMER (product information)
Industrial & Municipal Engineering Co. n.d.
Industrial & Municipal Engineering Co., P.O. Box 61, Galva, IL 61434.

Spill recovery, Skimmers, Design and engineering, *Oela-III skimmer

The Kaiser OELA-III is a compact oil skimmer unit for protected waters which can operate in less than 40 cm water depths. The unit recovers light as well as viscous oils.

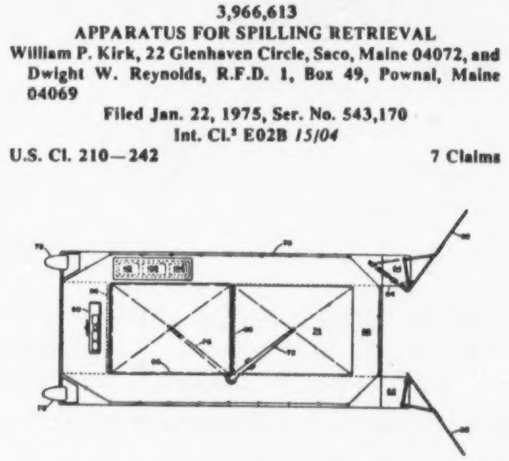
C-1170-77

APPARATUS FOR SPILLING RETRIEVAL
Kirk, W. P., and D. W. Reynolds. 1976.
U.S. Patent 3,966,613

Spill recovery, Design and engineering, Patent

A catamaran equipped with a pump, retrieval sheets, storage tank, and jib crane for recovering oil slicks or spillings from tankers is described and vessel operation on the open sea is discussed.

[from Selected Water Resources Abstacts 10(3):#W77-01202. 1977]



3,966,613
APPARATUS FOR SPILLING RETRIEVAL
William P. Kirk, 22 Glenhaven Circle, Saco, Maine 04072, and Dwight W. Reynolds, R.F.D. 1, Box 49, Pownal, Maine 04069
Filed Jan. 22, 1975, Ser. No. 543,170
Int. Cl.² E02B *15/04*
U.S. Cl. 210—242 **7 Claims**

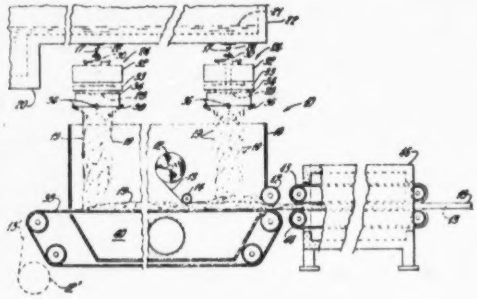
C-1171-77
OIL ABSORBENT MATERIAL AND METHOD OF OIL REMOVAL
Langlois, R. E. and C. R. Morrison. 1977.
U.S. Patent 4,006,079

Spill recovery, Absorption, Patent, *Glass fiber blankets

Oil spills are absorbed and removed with elongated, floating blankets of nonwoven, discontinuous glass fibers. The blankets absorb more than 30 times their weight in oil and are coated with a high-strength binder and a hydrophobic-oleophilic silicone material to increase absorption. The oil-soaked blankets are strong enough to be pulled lengthwise off the water surface.

[from Chemical Abstracts 86(18):#127067h. 1977]

4,006,079
OIL ABSORBENT MATERIAL AND METHOD OF OIL REMOVAL
Roland E. Langlois, and Charles R. Morrison, both of Newark, Ohio, assignors to Owens-Corning Fiberglas Corporation, Toledo, Ohio
Filed May 16, 1975, Ser. No. 578,239
Int. Cl.² C02B 9/02
U.S. Cl. 210—36 **1 Claim**



C-1172-77
HYDRODYNAMIC PROBLEMS IN OIL-SPILL CONTROL AND REMOVAL
Leibovich, S. 1977.
Journal of Petroleum Technology March:311-324.

Spill containment, Spill cleanup, Models, Booms, Skimmers, *Hydrodynamic problems

Fluid mechanics problems associated with oil spill containment and cleanup are mathematically analyzed to provide background information useful in the evaluation of spill control techniques and equipment. Three specific problems discussed are: the vertical dispersion of oil in turbulent water, the marked steepening of waves inside oil containment booms, and thickness variations of oil on waves. Mathematical models which describe the function of modular weir skimmers, rotating-disk skimmers, and endless oleophilic belt skimmers are presented.

C-1173-77
OIL ON CANADIAN COASTLINES
Logan, W. J. 1977.
Spill Technology Newsletter 2(1):11-12.

Environmental effects, Spill cleanup, Coasts, Restoration, Canada

Several regional and detailed coastline studies undertaken by the Canada Environmental Protection Service are announced. The major study is entitled, "Coastal Environments of Canada: the Impacts and Cleanup of Oil Spills." This report divides the Canada coastline into 34 coastal environments for each of which possible oil spill impacts are assessed and spill response, cleanup, and restoration methods are outlined.

C-1174-77
PROCESS AND APPARATUS FOR COLLECTING LIQUIDS FLOATING ON THE SURFACE OF ANOTHER LIQUID
Makaya, S. 1976.
French Patent 2,310,448

Spill cleanup, Skimmers, Oil-water separation, Patent

A process for collecting a liquid floating on the surface of another liquid is described. The floating material such as spilled oil enters the tank where it is separated into a layer; the lower liquid layer, water, is then pumped out of the tank.

[from Petroleum Abstracts 17(22):#233,870. 1977]

C-1175-77
PARTICLES FOR, AND METHOD OF, REDUCING OIL POLLUTION ON WATER
Marconi, W., N. Oddo, and L. Degen. 1977.
British Patent 1,461,577

Biodegradation, Oil slicks, Spill cleanup, Microorganisms, Patent, *Nutrient particles

A method for enhancing the microbial degradation of oil slicks is described, wherein nutrients such as ammonium salts, nitrates, and phosphates are contained in or adsorbed onto inert floating particles. The particles consist of paraffin and are dispersed over the floating pollutant.

[from Petroleum Abstracts 17(11):#231,309. 1977]

C-1176-77
OIL-AND FAT-ABSORBING POLYMERS
Marsh, H. E., Jr. 1976.
U.S. Patent Application 674,700

Spill recovery, Absorption, Patent, *Absorbent polymers

"Lightly-crosslinked, solvent extracted, urethane polymers and natural rubbers were prepared which had oil-absorbing capabilities > 900% and which showed potential in the control of oil spills in waterways."

[from Chemical Abstracts 86(14):91064p. 1977]

C-1177-77
PROCESS FOR PRODUCTION OF NOVEL PRODUCTS AND THEIR USE IN CONTROLLING POLLUTION BY OILY PRODUCTS
Martineau, J., and F. J. Biechler. 1977.
Canadian Patent 1,003,341

Spill recovery, Absorption, Skimmers, Patent, *Absorbent powder

A method of controlling oil pollution of water is described which involves contacting floating oil with a powdered substance so as to form a paste which is removed by skimming. The powder consists of a chromium complex chemically anchored to particles of a metallic aluminosilicate. The preparation of this powder is detailed.

[from Petroleum Abstracts 17(15):#232,332. 1977]

C-1178-77
THE HYDROVAC OIL-SPILL RECOVERY VESSEL
McDermott, P. 1976.
Ship & Boat International 29(2):29-30.

Spill recovery, Oil-water separation, Design and engineering

The oil salvage barge features continuous onboard separation of the salvaged oil-water mix, with the excess water being pumped overboard sheen-free. Two pumps have a total 200 tons/hour suction capacity with equivalent oil delivery capacity. System control is automatic, giving an hourly processing capacity of 100 tons of water-free oil when recovering a continuous 5 mm thick oil layer.

[from Oceanic Abstracts 14(1):#77-00638. 1977]

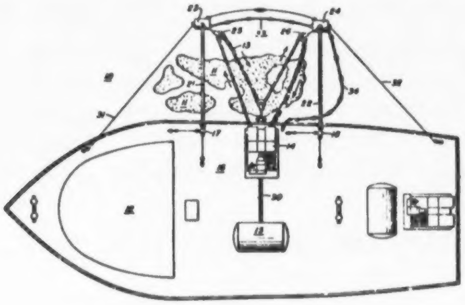
C-1179-77
RIGGING SYSTEM FOR AN ENDLESS OIL MOP
McLellan C. 1976.
U.S. Patent 3,990,975

Spill recovery, Design and engineering, Patent, *Oil mop rigging system

The rigging system allows an endless oil mop rope driven through a motorized wringer mechanism to make multiple oil collecting passes over and through an oil spill or oil slick from the deck of a vessel.

[from Petroleum Abstracts 17(9):#231,083. 1977]

3,990,975
RIGGING SYSTEM FOR AN ENDLESS OIL MOP
Charles McLellan, Slidell, La., assignor to Oil Mop Inc., Belle Chasse, La.
Filed Aug. 4, 1975, Ser. No. 601,934
Int. Cl.^{2} E02B *15/04*
U.S. Cl. 210—242 AS **3 Claims**



C-1180-77
PROCESS AND APPARATUS FOR REMOVING A LIGHT SUBSTANCE FLOATING ON THE SURFACE OF A LIQUID, AND IN PARTICULAR PETROLEUM FLOATING ON THE SURFACE OF WATER
Middelbeek, C. G. 1976.
French Patent 2,306,306

Spill recovery, Design and engineering, Patent, *Guided jet

"This apparatus for removing and collecting oil spilled on the surface of water consists of a guided element attached at its top to a guide and through which a fluid jet is projected. The guided element extends downward into the water and guides the jet just above the pollutant layer. The pollutant is then recovered."

[from Petroleum Abstracts 17(15):#232,318. 1977]

C-1181-77

STUDIES OF THE REMOVAL OF OILY SOIL BY ROLLING-UP IN DETERGENCY. PT. 2. ON BINARY SOIL SYSTEMS CONSISTING OF OLEIC ACID AND LIQUID PARAFFIN

Ogino, K., and K. Shigemura. 1976.
Bulletin of the Chemical Society of Japan 49(11):3236-3238.

Soil, Contamination, *Oil removal, *Detergents

The rolling-up mechanism of oily soil from the surface of a polypropylene (PP) sheet in an aqueous solution of sodium dodecylbenzene sulfonate (LAS) was studied by observing the contact angle (θ). The time required to remove the oily soil from the PP sheet by rolling-up became shorter with the increase in the liquid paraffin content of the mixture. The oily soil with binary components was more easily removed from the substrate than a single-component oily soil.

[from Petroleum Abstracts 17(17):#232,876. 1977]

C-1182-77

OIL OR ORGANIC SOLVENT-ABSORBENT

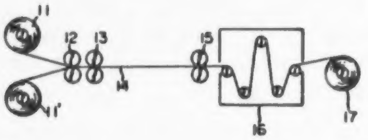
Omori, A., I. Okamura, T. Imoto, and T. Katoh. 1976.
U.S. Patent 3,966,597

Spill cleanup, Waste oil, Absorption, Rivers, Seawater, Patent

An oil or organic solvent-absorbent is described for absorbing or removing oils from the sea or rivers and for removing waste oils discharged from industrial effluents.

[from Selected Water Resources Abstracts 10(3):#W77-01200. 1977]

3,966,597
OIL OR ORGANIC SOLVENT-ABSORBENT
Akira Omori; Isao Okamura; Tadasi Imoto, all of Sagamihara, and Takayuki Katoh, Tokyo, all of Japan, assignors to Teijin Limited, Osaka, Japan
Continuation-in-part of Ser. No. 360,534, May 15, 1973, abandoned, which is a continuation-in-part of Ser. No. 136,511, April 22, 1971, abandoned. This application Dec. 5, 1974, Ser. No. 529,907
Claims priority, application Japan, July 28, 1970, 45-65893
Int. Cl.^{2} B01D *15/02*; B29D *27/00*; B32B *31/14*
U.S. Cl. 210—39 **27 Claims**



C-1183-77

COMPOSITION FOR REMOVAL OF IMMISCIBLE FLUIDS FROM WATER SURFACES AND LAKE BEDS
Peterson, E. C. 1976.
U.S. Patent 3,980,566

Spill recovery, Adsorption, Patent

Immiscible fluids such as oil spills are removed from the surface of water by placing an adsorbent compound on the water surface in contact with the spilled fluid and maintaining contact until the immiscible fluid is adsorbed. The adsorbent compound consists of a mixture of about 30-70% by weight lead slag mineral wool with the balance being a finely divided natural stone substance containing iron, aluminum, and magnesium oxides.

[from Selected Water Resources Abstracts 10(8):#W77-03870. 1977]

C-1184-77

APPARATUS FOR CLEANING POLLUTED WATER
Rafael, J. 1976.
British Patent 1,449,901

Skimmers, Ships, Design and engineering, Patent, *Wave damping device

An oil-skimming ship is described which can clean up oil in up to moderate swell conditions. In the bow of the ship, a floating body damps oncoming waves and thus allows the skimming of floating oil.

[from Chemical Abstracts 86(12):#78286t. 1977]

C-1185-77

SELECTION CRITERIA AND LABORATORY EVALUATION OF OIL SPILL SORBENTS
Robertson, L. A., M. F. Fingas, and L. B. Solsberg. (eds.). 1976.
Technology development report, EPS-4-EC-76-5. 53p.

Crude oil, Spill recovery, Absorption, Design and engineering, *Sorbents

Twenty oil spill sorbents were studied in terms of desirable performance and operational criteria using a Canadian western crude oil. Maximum sorbent capacity was correlated and compared with the viscosity of the oil recovered. The synthetic polymeric sorbents were found to exhibit the highest oil pick-up capacities and oil/water ratios.

[from Selected Water Resources Abstracts 10(6):#W77-02769. 1977]

C-1186-77
APPARATUS FOR FACILITATING THE REMOVAL OF FLOTATION MATERIAL
Rovel, J. M. 1977.
Canadian Patent 1,003,582

Spill recovery, Design and engineering, Oil-water separation, Patent

The apparatus consists of a network of vertical partitions which are in a horizontal plane at the upper edge and create a large number of vertical passages. Means are provided of overflow to maintain constant the level of the liquid so that the network is in the area occupied by the flotation material. A collection system for the surface layer is provided in the immediate vicinity of the network.

[from Petroleum Abstracts 17(16):#232,471. 1977]

C-1187-77
MINERALS ENRICHED IN IRON AND NICKEL FROM ASBESTOS MINE WASTES
Santt, R. 1976.
French Demande 2,294,994

Spill cleanup, Dispersions, Patent, *Asbestos mine wastes

Asbestos mine mineral wastes are processed to separate Fe-and Ni-containing parts; the remaining fines, particle size $< 100\mu$, are used as aqueous dispersions or gels to clean up oil slicks from sea water.

[from Chemical Abstracts 86(18):#124811k. 1977]

C-1188-77
TESTS OF THE ARCTIC BOAT CONFIGURATION OF THE LOCKHEED CLEAN SWEEP OIL RECOVERY SYSTEM IN A BROKEN ICE FIELD
Schultz, L. A. 1976.
Final report, USCG-D-108-76; Contract DOT-CG-51487-A. 85p.

Spill recovery, Skimmers, Crude oil, Freshwater, Ice, Arctic, *Lockheed Cleanup Sweep

Tests of the Lockheed Model R2003 "Arctic Boat" spill recovery device under simulated arctic conditions indicate that although in the Arctic Boat configuration the oil recovery rate and efficiency is improved, the performance of the unit is highly dependent on operating conditions.

[from Government Reports Announcements 77(5):#AD-A032 832/8GA. 1977]

C-1189-77
SLURP ADJUSTABLE WEIR OIL SKIMMER (product information)
Seaward International, Inc. n.d.
Seaward International, Inc., 6289 Leesburg Pike. Falls Church, VA 22044

Spill recovery, Skimmers, Design and engineering, *SLURP weir skimmer

The SLURP (Self Leveling Unit for Removing Pollution) is designed for removing floating oil layers from protected waters. The unit is lightweight, compact, corrosion-resistant and has no moving parts; the degree of weir immersion is remotely controlled from a pump. SLURP has a draft of only 13 cm (5") for the aluminum model, 25 cm (10") for the steel model, and operates in both smooth and choppy water.

C-1190-77
PROCESS FOR REMOVING PETROLEUM PRODUCTS FROM SOLID OR LIQUID SURFACES
Stein, C., and A. Marbach. 1976.
French Patent 2,288,709

Spill recovery, Petroleum products, Patent, *Adhesive polymer film

Oil on water or on the surface of solids is removed by contacting the oil with a finely divided polymer capable of forming with the petroleum products a film sufficiently resistant so that it can be pulled off the polluted surface by mechanical means.

[from Petroleum Abstracts 17(15):#232,328. 1977]

C-1191-77
POLYURETHANE FOAM WITH IMPROVED OIL ABSORPTION
Sumikura, T., H. Tenada, and S. Kaneko. 1976.
Japanese Patent 76 27,710

Emulsions, Absorption, Patent, *Polyurethane foam chips

Foam chips prepared from foamed polyurethane compounds containing an anhydrous metal sulfate such as Na_2SO_4 or $Al_2(SO_4)_3$ effectively absorb emulsified oils.

[from Chemical Abstracts 86(11):#70551e. 1977]

C-1192-77
OIL ADSORBENT
Takahashi, K., and Y. Okochi. 1976.
Japanese Kokai (unexamined patent application) 76,111,494

Adsorption, Patent, *Polyurethane foam

Polyurethane foams having continuous cell structure were treated with a methylhydrogen polysiloxane emulsion to yield an effective oil adsorbent material. In a test, the material adsorbed nearly 1g oil/cm^3 foam.

[from Chemical Abstracts 86(10):#56449w. 1977]

C-1193-77
FUNDAMENTAL STUDIES ON THE INFLUENCE OF OIL POLLUTION UPON MARINE ORGANISMS - II. LETHAL CONCENTRATIONS OF OIL-SPILL EMULSIFIER COMPONENTS FOR MARINE PHYTOPLANKTON
Tokuda, H. 1977.
Bulletin of the Japanese Society of Scientific Fisheries 43(1): 103-106.

Solvents, Surfactants, Toxicity, Emulsifiers, Phytoplankton

The lethal concentrations of solvents and non-ionic surfactants used as oil-spill emulsifiers were determined for two species of marine phytoplankton by culture experiments. The toxicity of petroleum solvents was dependent on their aromatic content. The surfactants with hydrophobic groups such as alkylphenol and secondary alcohol were highly toxic; the ester types were less toxic than the ether types.

C-1194-77
ICE CONDITIONS AND THE PROPOSED CONTAINMENT AND REMOVAL OF SPILLED OIL ON ST. CLAIR AND DETROIT RIVERS
Tsang, G. 1975.
Canada Centre for Inland Waters, Scientific Series No. 56. 30p.

Spill containment, Spill recovery, Rivers, Ice, Booms. Canada, *St. Clair and Detroit rivers

A method is examined for dealing with oil spills on the St. Clair and Detroit rivers during ice conditions which may interfere with spill containment and removal operations. Dynamic analysis is suggested for the design of ice and oil booms, and equations for the design of booms under specific conditions are given. Surface skimming by high-volume pumping for removal of oil and oil-frazil ice mixtures is discussed.

[from Selected Water Resources Abstracts 10(4):#W77-01802. 1977]

C-1195-77
FLEXIBLE CONCENTRATOR FOR THE RECOVERY OF POLLUTING LIQUIDS FLOATING ON THE SURFACE OF A BODY OF WATER
Vidilles, J. 1976.
French Patent 2,303,120

Spill recovery, Design and engineering, Patent, *Flexible floating pipe

A flexible floating pipe is described which concentrates and recovers oil spills or other immiscible liquids floating on water. The pipe is oriented perpendicular to the direction of the current and has entry openings parallel to the water surface.

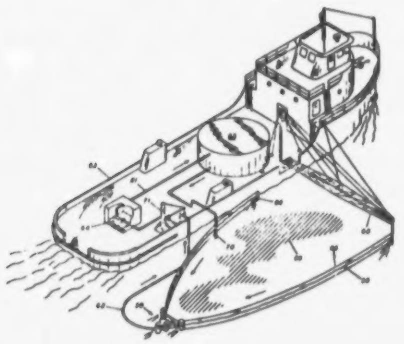
[from Petroleum Abstracts 17(15):#232,329. 1977]

C-1196-77
APPARATUS AND METHOD OF REMOVING DEBRIS FLOATING ON A BODY OF WATER
Wilson, D. E. 1976.
U.S. Patent 3,983,034

Spill cleanup, Skimmers, Booms, Design and engineering, Patent

An apparatus for skimming oil spills from the water surface consists of three adjustably buoyant pontoons, one located in each of the corners of a triangle made up of interconnecting structural members. At the base of the triangle is the skimmer mouth sloping upwards towards a sump. Two pontoons on each side of the sloped mouth guide the oil slick into the skimmer. Once there the slick flows over a self-adjusting weir into a sump.

3,983,034
APPARATUS AND METHOD OF REMOVING DEBRIS FLOATING ON A BODY OF WATER
Donald E. Wilson, Dhahran, Saudi Arabia, assignor to Chevron Research Company, San Francisco, Calif.
Continuation of Ser. No. 410,122, Nov. 26, 1973, abandoned. This application Jan. 3, 1975, Ser. No. 538,494
Int. Cl.² E02B *15/04*
U.S. Cl. 210—73 W **9 Claims**



3. RESTORATION

C-1197-77
NEW TECHNIQUE FOR OILED BIRDS (news brief)
Anon. 1977.
Massachusetts Audubon 16(6):3.

Restoration, Birds, Oil spills, Solvents

The Royal Society for the Protection of Birds rehabilitation program for oiled birds is presented. A bird can be cleaned using a solvent and released within a few days provided the feathers have been aligned properly. It is believed that the bird's natural oil has less to do with buoyancy and insulation than once thought. If the feathers can be restored, the bird has a good chance of survival.

C-1198-77
TO SAVE A BIRD, PREVENT A SPILL (news brief)
Anon. 1977.
Audubon 79(2):160.

Restoration, Birds, Oil spills, Contamination, Torrey Canyon, Olympic Games spill

Efforts to save oiled waterfowl after the "Olympic Games and "Torrey Canyon" tanker oil spills are reviewed and requirements for bird survival during rehabilitation are discussed. It is essential that specific food requirements of each species be met and proper cleaning and handling by volunteers are achieved in order to maximize the survival of the birds.

C-1199-77
OILY BIRDS
Grant , D. 1977.
Underwater Naturalist 10(2):18-19.

Restoration, Birds, Olympic Games spill , Personnel training,

An account is given of the rescue and rehabilitation of oiled waterfowl along the Delaware-New Jersey coast after the "Olympic Games" oil spill in December, 1976. Treatment procedures for cleaning the birds are given and the lack of trained personnel in the rehabilitation effort is discussed.

4. OIL TRANSFER AND TRANSPORT

C-1200-77
UNITED STATES (news brief)
Anon. 1977.
Marine Pollution Bulletin 8(3):53.

Oil spills, Tankers, Legislation, Pollution prevention, U.S.

The Sierra Club and eight other U.S. environmental groups have called for new legislation for oil-tanker safety as a direct result of the "Argo Merchant" oil spill. The organizations are calling for specific design, construction and equipment features to reduce oil spillage and are criticizing the U.S. Coast Guard for failing to adhere to the 1972 U.S. Ports and Waterways Act.

C-1201-77
OIL FROM MERCHANT SHIPS (news brief)
Bourne, W. R. P. 1977.
Marine Pollution Bulletin 8(4):75.

Oil discharges, Harbors, Oceans, Ships, *Merchant ships

The author points out that merchant shipping should not be forgotten as a source of oil pollution in harbors and at sea. It has been recorded that merchant ships are known to pump excess oil in their tanks overboard when preparing to enter dock for inspection, and any remaining oil is then likely to be discarded into the bilges which are pumped out when the vessel leaves port.

C-1202-77
PUGET SOUND SWEATS OUT GROWING TANKER TRAFFIC (news brief)
Browning, R. J. 1977.
National Fisherman 57(11):3A,26A.

Oil transport, Tankers, Oil spills, Legislation, Puget Sound, Washington

Background information is provided on the possibility of oil tanker traffic in Puget Sound, and recent legislation banning movement of tankers of more than 125,000 dwt in the Strait of Juan de Fuca is discussed. Oil spill projections over the next 20 years are outlined for Washington.

C-1203-77

IMPACT OF THE TRANSPORTATION OF PETROLEUM OF THE WATERS ON THE NORTHEASTERN PACIFIC OCEAN
Clark, R. C., Jr. 1976.
Marine Fisheries Review 38(11):20-26.

Oil transport, Oil discharges, Sources, Fate, Biological effects, Marine organisms, Fisheries, Pacific Ocean

The sources of oil pollution, the chemical, physical and biological fate of oil, and the potential effects of increased tanker traffic or marine resources of the northeastern Pacific Ocean are discussed.

C-1204-77

ARCTIC ADAPTS - ENGINEERING ANALYSIS, PROTOTYPE DEVELOPMENT AND TESTING
Clarke, M. L., D. W. Durfee, and S. H. Shaw. 1976.
Final report, USCG-D-123-76; Contract DOT-C651864A. 161p.

Oil transfer, Ships, *Pumps, Design and engineering, Arctic, *ADAPTS

ADAPTS is a portable pumping system consisting of a diesel/hydraulic power supply and a hydraulic motor-powered axial flow, submersible turbine pump expressly built by the Coast Guard for off-loading damaged tank ships. An engineering study to analyze the feasibility of using the ADAPTS pumping systems in an arctic environment is presented.

[from Government Reports Announcements 77(9):#AD-A035 916/6GA. 1977]

C-1205-77

IMPLICATIONS OF THE U.S. COAST GUARD SEGREGATED BALLAST RETROFIT RULING ON IMPORT ALTERNATIVES AND POLLUTION OF THE MARINE ENVIRONMENT
Dayton, R., F. Daniels, L. Stoehr, and J. Kirkland. 1976.
Final report, ORI-TR-1096, USCG-M-06-77; Contract N00014-76-C-0918. 128p.

Pollution control, Tankers, Segregated ballast, Regulations, USCG, Cost analysis, Environmental protection

This study was undertaken to estimate the economic costs and environmental benefits to be derived from implementing the USCG regulation which would require the backfitting of segregated ballast tanks on all tankers engaged in importing oil to the U.S. and to examine the economic feasibility of alternative oil importing schemes which could circumvent the proposed regulation.

[from Government Reports Announcements 77(7):#AD-A034 840/9GA. 1977]

C-1206-77
THE APPLICABILITY OF THE MILFORD HAVEN EXPERIENCE FOR NEW OIL TERMINALS
Dicks, B. 1976.
Marine Ecology and Oil Pollution. J. M. Baker (ed.). New York, John Wiley & Sons, 1976. p.67-79. Institute of Petroleum/Field Studies Council Meeting, Aviemore, Scotland, 1975.

Oil transfer, Ports, Environmental effects, Oil discharges, Marine organisms, UK, *Milford Haven

To illustrate some of the special characteristics of Milford Haven and come of the differences between this port and other development sites, a brief comparison is made of Milford Haven with two potential development areas: Sullom Voe and the Cromarty Firth. A number of coincidental factors have contributed toward keeping Milford Haven clean. If these factors are duplicated or fully understood and taken into account at new sites, then a wide range of experience, in terms of port management and effects of development on shore life, become applicable to these areas. If not, extrapolation of the Milford Haven experience to new oil terminals is regarded as dangerous.

C-1207-77
A METHOD TO ESTIMATE THE POLLUTION RISK AND COST OF OCS OIL TRANSPORTATION
Donovan, L. J., and J. J. Owen, III. 1977.
Journal of Petroleum Technology, June:639-648.

Oil transport, OCS, Oil spills, Economics, Storage, Tankers, Pipelines, Oil tanks, Gulf of Alaska, *Risk analysis

A method is presented for combining best available economic and spill risk data into a format useful in making rational decisions about the transport of oil from the Gulf of Alaska to the U.S. West Coast. Separate oil spill risk analyses are presented for oil transport by tankers, pipelines and storage facilities including onshore storage, offshore floating tanks and ocean-floor tanks. Tanker transport is analyzed by a simulation model.

C-1208-77
STRATEGIC PETROLEUM RESERVE
Federal Energy Administration. 1976.
Final environmental impact statement, FEA/S-76/488, FES 76-2. 304p.

Crude oil, Storage, Environmental effects, EIS, *Salt domes, *Tank farms, *Strategic Petroleum Reserve

The potential environmental impacts of implementing the Strategic Petroleum Reserve program are assessed. This involves the securing of nearly 500 million bbl of oil in long-term storage facilities, such as salt domes and tank farms, as a national reserve against the possible interruption of foreign oil imports. Further study is recommended of the feasibility of offshore and onshore salt domes excavation, the substitution of seawater for fresh water in onshore salt-dome excavation, and the reuse of waste brines from injection aquifers for oil displacement during emptying of salt-dome storage cavities.

[from Petroleum Abstracts 17(13):#231,853. 1977]

C-1209-77
STRATEGIC PETROLEUM RESERVE: BAYOU CHOCTAW SALT DOME
Federal Energy Administration. 1976.
Final environmental impact statement, FEA/S-76/501, FES-76-5.
595p.

Crude oil, Storage, Environmental effects, EIS, Louisiana, *Bayou Choctaw Salt Dome

The Bayou Choctaw site, a salt dome with existing cavities located in Iberville Parish, Louisiana, has been selected as a candidate site for the proposed storage of crude oil because it offers the advantage of large storage capacity, easy access to the distribution network, and a short preparation period. This site-specific EIS assesses the environmental impacts caused by site preparation and operation.

[from Petroleum Abstracts 17(13):#231,854. 1977]

C-1210-77
STRATEGIC PETROLEUM RESERVE. BRYAN MOUND SALT DOME.
Federal Energy Administration. 1977.
Final environmental impact statement, FEA/S-76/502, FES 76/77-6.
542p.

Crude oil, Storage, Environmental effects, EIS, Oil transport, Water quality, *Bryan Mound Salt Domes

Construction and preparation of storage cavities, dock facilities, and pipelines would degrade water quality by increasing the amount of suspended particulates, toxic sulfides, heavy metals, arsenic, and toxic hydrocarbons. Crude oil loading, unloading and transportation operations create the risk of oil spills which have the potential to disrupt the aquatic ecosystem and would cause evaporative hydrocarbon emission which would temporarily exceed the federal standard.

[from Petroleum Abstracts 17(13):#231,856. 1977]

C-1211-77
STRATEGIC PETROLEUM RESERVE. CENTRAL ROCK MINE
Federal Energy Administration. 1976.
Draft environmental impact statement, FEA/S-76/489, DES 76-9.
460p.

Crude oil, Storage, Environmental effects, EIS, Water quality, Oil spills, Kentucky, *Central Rock Mine

This site-specific environmental impact statement assesses the environmental parameters for the Central Rock, Kentucky, Early Storage Reserve site. Adverse impacts include degradation of surface water quality due to sedimentation from runoff and erosion during pipeline construction, a moderate increase in hydrocarbon emissions during transfer and temporary storage of oil in the Tates Creek storage tanks, and the potential for an increase in the frequency of oil spills along transportation corridors. Changes in water quality would have a short-term impact on the aquatic organisms in local areas and could result in significant sedimentation in a downstream impoundment.

[from Petroleum Abstracts 17(13):#231,850. 1977]

C-1212-77
STRATEGIC PETROLEUM RESERVE. COTE BLANCHE MINE
Federal Energy Administration. 1977.
Final environmental impact statement, FEA/S-77/016, FES 76/77-7.
746p.

Crude oil, Storage, Environmental effects, EIS, Water quality, Oil spills, Louisiana, *Cote Blanch Mine

This site specific environmental impact statement assesses the Cote Blanche salt mine in St. Mary Parish, Louisiana, for the proposed storage of oil. Adverse impacts to the environment include degradation of surface water quality due to erosion from runoff during construction and dredging activities, increase in hydrocarbon emissions during the filling of petroleum carrying vessels, and the potential for an increase in the frequency of oil spills along transportation corridors. Changes in water quality would have a short-term impact on the local aquatic organisms.

[from Petroleum Abstracts 17(3):#231,857. 1977]

C-1213-77
STRATEGIC PETROLEUM RESERVE. IRONTON MINE
Federal Energy Administration. 1976.
Draft environmental impact statement, FEA/S-76/490, DES 76-10.
494p.

Crude oil, Storage, Environmental effects, EIS, Water quality, Oil spills, Ohio, *Ironton Mine

This site-specific environmental impact statement assesses the environmental parameters for the Ironton, Ohio, Early Storage Reserve Site. Adverse impacts include degradation of surface water quality due to sedimentation from runoff and erosion during pipeline construction, and the potential for an increase in the frequency of oil spills along transportation corridors. Changes in water quality would have a short-term impact on the local aquatic organisms. No signficant adverse socio-economic effects have been identified.

[from Petroleum Abstracts 17(13):#231,851. 1977]

C-1214-77
STRATEGIC PETROLEUM RESERVE. KLEER MINE
Federal Energy Administration. 1977.
Draft environmental impact statement, FEA/S-77/003, DES 77-2.
556p.

Crude oil, Storage, Environmental effects, EIS, Water quality, Oil spills, Texas, *Kleer Mine

This site-specific environmental impact statement assesses the environmental parameters for the Kleer Mine, Texas, Early Storage Reserve Site. Adverse impacts include degradation of surface water quality due to sedimentation from runoff and erosion during pipeline construction, a moderate increase in hydrocarbon emissions during transfer and temporary storage of oil in Winnsboro storage tanks, locally significant increases in hydrocarbon emissions during transport of oil from the Gulf of Mexico to Winnsboro Terminal, and the potential for an increase in the frequency of oil spills along the transportation corridors.

[from Petroleum Abstracts 17(13):#231,852. 1977]

C-1215-77
STRATEGIC PETROLEUM RESERVE. WEEKS ISLAND MINE
Federal Energy Administration. 1977.
Final environmental impact statement, FEA/S-77/017, FES 76/77-8.
742p.

Crude oil, Storage, Environmental effects, EIS, Water Quality, Oil spills, Louisiana, *Weeks Island Mine

This site specific environmental impact statement assesses the Weeks Island salt mine in Iberia Parish, Louisiana, for the proposed storage of crude oil. Adverse impacts to the environment include degradation of surface water quality due to erosion from runoff during construction and dredging activities, increase in hydrocarbon emissions during the filling of petroleum-carrying vessels, and the potential for an increase in the frequency of oil spills along transportation corridors. Changes in water quality would have a short-term impact on the local aquatic organisms.

[from Petroleum Abstracts 17(3):#231,858. 1977]

C-1216-77
STRATEGIC PETROLEUM RESERVE. WEST HACKBERRY SALT DOME
Federal Energy Administration. 1977.
Final environmental impact statement, FEA/S-76/503, FES 76/77-4. 615p.

Crude oil, Storage, Environmental effects, EIS, Oil transport, Water quality, *West Hackberry Salt Dome

Construction and preparation of storage cavities, dock facilities, and pipelines would degrade water quality by increasing the amount of suspended particulates, toxic sulfides, heavy metals, arsenic, and toxic hydrocarbons. Crude oil loading, unloading and transportation operations create the risk of oil spills and would cause evaporative hydrocarbon emission which would temporarily exceed the federal standard. Displacement of crude oil during drawdown operations could cause some surface subsidence over water-storage areas, slow salt-water encroachment, and movement of near-surface geologic faults.

[from Petroleum Abstracts 17(13):#231,855. 1977]

C-1217-77
STRATEGIC PETROLEUM RESERVE PLAN (PUBLIC LAW 94-163, SECTION 154)
Federal Energy Administration. 1976.
FEA/S-76/45A. 349p.

Crude oil, Storage, Environmental effects, Economic effects, FEA, *Strategic Petroleum Reserve

The Energy Policy and Conservation Act of 1975 requires the FEA to implement the Strategic Petroleum Reserve in order to mitigate the economic impacts of any future interruptions of petroleum imports. One hundred fifty MMB of oil will be stored by 1978 and five hundred MMB will be stored by 1982 under the program. This report discusses FEA's plan for developing the Strategic Petroleum Reserve.

[from Government Reports Announcements 77(7):#PB-261 737/1GA. 1977]

C-1218-77
THE VALDEZ CONNECTION
Fradkin, P. L. 1977.
Audubon 79(2):134-140.

Oil transport, Oil spills, Tankers, Environmental effects, Alaska, *Valdez Narrows

A discussion of oil tanker traffic and possible oil spills in the Valdez Narrows, Alaska, is presented. A historical account of environmental and developmental meetings on oil transport in Arctic waters is given. It is the opinion of the author that an oil spill from a tanker disaster is inevitable.

C-1219-77
SUPERTANKERS - COMING OR GOING?
Frye, J. 1977.
Sea Frontiers 23(2):76-83.

Tankers, Oil transport, Economics, Oil discharges, Oil spills, Environmental effects, *Supertankers

The future of VLCC's (very large crude carriers) is in doubt due to the sharp increases in crude oil prices, reduced demand for petroleum products, and resulting nonuse of supertankers. The series of spill disasters has confirmed suspicions in the minds of some groups that these ships constitute a menace on the seas.

C-1220-77
COOLING OF OIL IN SUNKEN OR DISABLED TANKERS
Graham, J. W., A. Y. McLean, and M. E. Norwood. 1977.
Spill Technology Newsletter 2(1):13-22.

Oil transfer, Tankers, Models, *Oil cooling rates

Oil is commonly heated to decrease its viscosity and improve its handling characteristics during transfer operations. This article reports on a field experiment and computer simulation study of the cooling rates and behavior of oil in cold water environments. The computer analysis was applied to the recent "Irving Whale" and "Argo Merchant" tanker spills and was found to reliably predict cooling rates of oil in closed vessels surrounded by cold water.

C-1221-77
EFFECT OF IMCO POLLUTION REGULATIONS ON SHIPPING
IMCO. 1975.
Conference of Marine Media Management Ltd., London, 1974. 26p.
(Institute of Marine Engineers - Transactions Proceedings of
Papers Series B)

Regulations, Pollution prevention, Ships, Monitoring, IMCO

Six papers are presented on the following topics in marine pollution: a review of current and future pollution regulations; the facilities required to reduce pollution in ports and rivers; the disposal of sewage and garbage at sea; the marine application of monitoring oil in water; and equipment development for incineration and sewage treatment.

[from MRIS Abstracts 14:#14 141401. 1976]

C-1222-77
OCEANOGRAPHIC COMMISSION
Ledbetter, B. G. 1975.
Annual report, Natural Resources and Recreation Agencies. p.57-62.

Oil transfer, Offshore development, Environmental effects, Socioeconomic effects, Cost analysis, Models, Spreading

A study concerned with the feasibility of offshore petroleum transfer systems in terms of engineering, environmental, economic, social and jurisdictional factors is presented. Cost benefits, advantages, and impacts were analyzed and a literature search of oil spreading models was undertaken.

[from Selected Water Resources Abstracts 10(9):#W77-04359. 1977]

C-1223-77
STUDIES OF OIL SPILLS FROM BLOWOUTS AND BROKEN UNDERWATER PIPELINES
Mundheim, O. 1976.
Offshore North Sea Technology Conference, Stavanger, Norway, 1976.
Stavanger, Norway, NOROIL Publishing House, 1976. Safety and
Environmental Protection Section, Paper S-111/3. 27p. Summary.

Oil transport, Pipelines, Oil spills, Leakage, Fate, Spreading, Evaporation, Models, *Ignition hazards

The results of an analytical study on the fate of oil spillage from pipelines breaks and leaks in deep water (over 150 m) are summarized. The first part of the study estimates the rates and quantities of oil losses from broken pipelines using mathemetical models. In the second part of the study, the surface behavior and fate of a pipeline spill are assessed,including predictions of spreading rates, thickness of slicks, evaporation rates, and ignition hazards.

C-1224-77
ALASKANS WORRIED AS TIME NEARS FOR INFLUX OF TANKERS (news brief)
Munro, N. 1977.
National Fisherman 57(11):27A.

Oil transport, Tankers, Ports, Oil spills, Environmental effects, Alaska, *Valdez Narrows

Tanker traffic in the Valdez Narrows, Alaska, is discussed and the recent decision to send a tanker through the Narrows on a trial run is outlined. Citizen opposition and environmental effects of a possible oil spill are presented.

C-1225-77
TEMPORARY STORAGE AND ULTIMATE DISPOSAL OF OIL RECOVERED FROM SPILLS IN ALASKA
Peterson, P. L., R. A. Yano, and M. M. Orgill. 1975.
U.S. Coast Guard report, CG-D-181-75. 239p.

Spill disposal, Storage, Crude oil, Fuel oil, Alaska

Seven representative sites felt to be future areas of high spill potential are evaluated with respect to storage and disposal of spills of 100 to 50,000 bbls. Potential adverse effects of the Alaskan environment on oil spill handling, storage and disposal are compared to more temperate environments. It was concluded that all temporary storage should be on land. In-situ burning was the preferred method of disposal at virtually all sites evaluated.

[from Aquatic Sciences & Fisheries Abstracts 7(3):#7Q3161. 1977]

C-1226-77
OIL SPILLS: A DILEMMA TO BE RESOLVED (news brief)
Rowland, W. G., Jr., and M. L. Millstone. 1977.
Journal Water Pollution Control Federation 49(3):357-359.

Argo Merchant spill, Tankers, Safety, Contingency planning, Liability, USCG, Gulf of Mexico, *Flags of convenience

The "Argo Merchant" oil spill and "flags of convenience" are discussed with reference to tanker safety and U.S. Coast Guard responsibilities. Measures to set up a contingency fund along with liability laws are viewed as a necessity if supertankers are to be allowed in the Gulf of Mexico.

C-1227-77
THE TRANS-ALASKA PIPELINE AND STRICT LIABILITY FOR OIL POLLUTION DAMAGE
Stone, A. G. 1975.
Urban Law Annual 9:179-201.

Pipelines, Development, Environmental effects, Oil spills, Legislation, Liability, Alaska

The development and environmental effects of the Alaskan pipeline are examined in light of the 1973 Trans-Alaska Pipeline Authorization Act. The Act's inclusion of strict liability for damage caused by oil pollution and a proposed general adoption of strict liability for all oil transportation and storage are discussed. The environmental problems raised include damage to the permafrost, the earthquake risk, and the impact of oil spills in arctic waters resulting in bird and fish destruction.

[from Selected Water Resources Abstracts 10(10):#W77-04907. 1977]

5. WASTE TREATMENT AND DISPOSAL METHODS

C-1228-77
OIL EMULSION REMOVAL
(Amchem Products, Inc.) 1976.
Australian Patent 478,697

Emulsions, Oil-water separation, Patent, *Demulsification

An oil emulsion removal process consists of the following: removing the oil emulsion from objects by contacting them with a solution of wash water and demulsifier, thereby providing a turbulent mixture; collecting this mixture containing demulsifier for breaking the oil emulsion to separate oil; removing the separated oil from the wash water in a quiescent stage; and recycling the wash water and demulsifier.

[from Petroleum Abstracts 17(18):#233,092. 1977]

C-1229-77
EMULSION BREAKING PROGRAMS RECOVER VALUABLE OIL, REDUCE POLLUTION (product information)
Anon. 1977.
Pacific Oil World 70(5):36-37.

Wastewater treatment, Emulsions, Oil-water separation, Sludge

A bulletin published by NALCO Chemical Company explains how treatment of oily wastewater and wastewater emulsions can improve oil-water separation, reduce sludge volumes and improve effluent quality. The publication, Bulletin PC-1, entitled "Reduce Pollution, Recover Oil with NALCO Emulsion Breaking Programs," is available from NALCO Chemical Company, 2901 Butterfield Rd., Oak Brook, IL 60521.

C-1230-77
MACHINE TREATS WASTEWATER IN CAPACITIES TO 5,000 GPM (product information)
Anon. 1977.
Oil and Gas Journal 75(17):198.

Wastewater treatment, Emulsions, Oil-water separation, Design and engineering

Emulsified oils and solids are removed from water by forced aeration in the "Hydrocleaner" wastewater treatment machine. The machines are available in 190-19,000 l/min (50 to 5000 gal/min) capacities, handle wastewaters containing up to 5000 ppm oil, usually discharge less than 10 ppm oil, and use half the power of other machines. FFI contact WEMCO Division, Envirotech Corporation, P.O. Box 15619, Sacramento, CA 95813.

C-1231-77
NEW BREAKTHROUGH IN RECOVERING OIL FROM WATER (product information)
Anon. 1977.
Sea Technology 18(3):27.

Oil-water separation, Design and engineering

The RDS oil-water separator recovers and separates oil from oily water mixtures. Designed by Marine Construction and Design Co. (MARCO), Seattle, WA, the system permits ultra-small oil droplets to rise and to separate for recovery and reduces the total oil content to 10 ppm or less.

C-1232-77
NRL RESEARCHERS DEVELOP SYSTEMS TO DEMULSIFY, OILY WASTE (news brief)
Anon. 1977.
Sea Technology 18(3):37-38.

Waste oil treatment, Emulsions, Bilges, Oil tanks, Spill recovery, *Demulsifying agents

A new pair of chemical agents for use in demulsifying oily waste found in ship bilges, fuel tanks, and oil spills have been developed by the Naval Facilities Engineering Command (NAVFAC). This system could be used to remove water from recovered oil during spill recovery operations; thus fewer oil transport barges would be required.

C-1233-77
OIL/WATER SEPARATORS HAVE MANY USES (product information)
Anon. 1977.
Pacific Oil World 70(3):47.

Wastewater treatment, Oil-water separation, Ships, Refineries, Design and engineering

General Electric's Oil/Water Separators are designed to clean oily wastewater, to reclaim the oil, and provide an environmentally suitable effluent. Operation and maintenance costs are minimal since the separators utilize patented coalescing plates, require no filters, and are fully automatic. Oil/Water Separators are available for both shipboard and industrial applications.

C-1234-77
ULTRAFILTRATION DEVELOPMENT AIDS WASTE OIL DISPOSAL
Anon. 1976.
Water and Pollution Control 114(12):34.

Waste oil disposal, Emulsions, Oil-water separation, Filtration

A simple and economic system for separating oil-water emulsions into oil concentrate and clean water at up to 13,600 l/day (3,600 gal/day) is described. The process forces oily effluent through a semipermeable membrane that holds back oil and transmits only clean water. The oil concentration is increased up to about 50% and the oil concentrate is removed for incineration or refining.

[from Pollution Abstracts 8(3):#77-02516. 1977]

C-1235-77
AFL INDUSTRIES ... ANSWERS TO INDUSTRIAL WASTE WATER POLLUTION (product information)
AFL Industries. n.d.
AFL Industries, 1149 Howard Drive, West Chicago, IL 60185

Oil-water separation, Wastewaters, Inland, Skimmers, Design and engineering, *AFL Industries

A 38-page brochure describes the company's line of oil-water separation equipment for land-based applications. Items include a series of API gravity differential separators of 40-2800 l/min (10-750 gal/min) flow rates, and ancillary products such as automatic skimmers, rotary pipe skimmers, and polishing pack separators.

C-1236-77
PURIFICATION OF WASTE WATERS FROM PETROCHEMICAL INDUSTRIES [in Russian]
Amosov, V. A., A. G. Zil'berman, E. I. Kucheryavykh, E. I. Sorkin, L. Ya. Tsarik, S. A. Eppel, V. E. Timoshek, and I. P. Titov. 1976.
Khimiya i Tekhnologiya Topliv i Masel (11):26-28.

Petrochemicals, Wastewater treatment, pH control, Oxidation, Flotation, Coagulation

Petrochemical wastewaters were purified by a number of described processes, including pH adjustment, aeration-oxidation, foam flotation and electro-coagulation. Results are presented and compared.

[from Chemical Abstracts 86(16):#110750c. 1977]

C-1237-77
PURIFICATION OF EFFLUENTS CONTAINING OILS AND HYDROCARBON EMULSIONS IN WATER
Askienazy, A., V. Ken, J. C. Masson, and J. Lemarquand. 1976.
French Demande 2,284,566

Wastewater treatment, Emulsions, Oil-water separation, pH control, Patent, *Zn salts

Oil-in-water emulsions are broken by adding a Zn salt at pH 7-8 to the wastewater. The amount of salt added depends on the quantity of hydrocarbons or oil in the water.

[from Chemical Abstracts 86(18):#126811j. 1977]

C-1238-77
INDUSTRIAL WASTEWATER MANAGEMENT HANDBOOK
Azad, H. S. (ed.). n.d.
New York, McGraw-Hill. 800p.

Wastewater treatment, Oil industry, Petrochemicals, Refineries, Pollution control, Manuals

Water pollution control problems faced by six specific industries and their sub-industries, including the petroleum and petrochemical industry, are covered in detail. Data, materials, preventive measures and solutions are described for each industry.

[from Chemical Engineering 84(12):41. 1977]

C-1239-77
CONCENTRATION OF OILY AND LATEX WASTEWATERS USING ULTRAFILTRATION INORGANIC MEMBRANES
Bansal, I. K. 1976.
Industrial Water Engineering 13(5):6-11.

Wastewater treatment, Emulsions, Filtration, Economics, *Ultrafiltration membrane

The performance of an ultrafiltration (UF) membrane made up of thin inorganic layers deposited on the inside of porous carbon tubes was assessed under laboratory and pilot conditions. Both waste oil emulsions and dilute latex wastewaters were tested. UF systems alone effectively concentrated waste oil emulsions to ≥ 25%; additional acid treatment raised this to 70% oil. The membrane effectively rejected between 99.50 and 99.99% oil. The economics of UF treatment are favorable compared to oily wastewater disposal at present hauling rates.

[from Pollution Abstracts 8(3):#77-02443. 1977]

C-1240-77
WASTE TREATMENT ADVANCES; FLUID BED INCINERATION OF WASTES; FLUOSOLIDS REACTOR SYSTEMS
Becker, K. P., and C. J. Wall. 1976.
Chemical Engineering Progress 72(10):61-68.

Sludge, Refineries, Incineration, Disposal, Design and engineering, *Fluid bed incineration

Fluid bed incineration of six petroleum refinery wastes is detailed and reaction mechanisms for sludges undergoing this type of disposal are given. Three different systems of Fluosolids Reactors are illustrated and discussed.

C-1241-77

PURIFICATION OF WASTES FROM CATALYST PRODUCTION IN PETROLEUM REFINERIES [in Russian]

Blagodarnaya, L. F., and M. G. Dyuzhakin. 1976.
Khimiya i Teknologiya Topliv i Masel (11):28-30.

Wastewater treatment, Refineries

"After pretreatment or settling, the waters were treated physicochemically and then biochemically. Alternately, the concentration of suspended and ether-soluble matter was decreased by mixing wastes from catalyst manufacture and chemical purification and settling in a settling homogenization tank."

[from Chemical Abstracts 86(16):#110752e. 1977]

C-1242-77

BASIC CONCEPTS OF METHODS FOR PREDICTING THE COMPOSITION OF WASTE WATER DISCHARGED INTO A BODY OF WATER [in Russian]

Bolotina, O. T. 1976.
Vodnye Resursy (5):141-152.

Wastewater treatment, Disposal, Contaminants, Petroleum products

A prediction of the composition of discharged wastewaters is based on: (1) a wastewater treatment sequence consisting of sedimentation, biological treatment and filtration-adsorption-disinfection; and (2) prescribed efficiencies of contaminant removal for each stage of the treatment sequence. Contaminants considered in this prediction include suspended matter, COD, petroleum products, biodegradable surfactants, resistant surfactants and phenols.

[from Chemical Abstracts 86(14):#95495c. 1976]

C-1243-77

PROCESS AND APPARATUS FOR ELIMINATING OIL FROM WATER CONTAMINATED WITH OIL

Bruadribb, M. P., R. C. Pitkethly, and M. W. Tideswell. 1976.
French Patent 2,292,676.

Wastewater treatment, Petroleum products, Filtration, Coalescence, Design and engineering, Patent

An apparatus for purifying water that contains oil or petroleum products is described. It consists of a chamber with an inlet and two outlets which contains several beds of particulate matter spaced between perforated plates. After liquid passes through the granular beds it enters a decantation zone where the oil is removed.

[from Petroleum Abstracts 17(15):#232,320. 1977]

C-1244-77
TREATMENT OF LUBRICATING OILS CONTAMINATED WITH WATER AND SOLIDS
Busch, F. 1976.
German Offenlegungsschriften (unexamined patent application) 2,507,270

Waste oil treatment, Lubricating oil, Reclamation, Patent

"The contaminated oil was intimately mixed with 0.01%-1% Ba-, Pb-, or basic Ba-dinonylnaphthalenesulfonate in the form of a 50% oily solution, and allowed to settle for 8-16 hrs at 70-80°. The oil was separated from the aqueous phase and used again."

[from Chemical Abstracts 86(14):#92970t. 1977]

C-1245-77
COALESCENCE OF EMULSIFIED OILY WASTEWATER BY FIBROUS BEDS
Chieu, J.-N., E. F. Gloyna, and R. S. Schechter. 1975.
Annual Purdue Industrial Waste Conference, 30th, 1975.

Wastewater treatment, Oil-water separation, Emulsions, Coalescence

The feasibility of fibrous bed coalescers to separate emulsified oil from industrial waste streams was investigated while varying influent oil concentration, flow rate and bed depth. Three coalescing media and 4 types of oil were used. The results of these experiments allow the conclusion that fibers preferentially wetted by the dispersed phase are best, a minimum oil saturation of 10-15% of the bed is necessary for complete coalescence, and a minimum coalescer depth is required.

C-1246-77
DEVICE FOR EVALUATING COALESCENCE OF OIL EMULSIONS
Chieu, J.-N., and E. F. Gloyna. 1975.
ASCE Meeting, Texas Section, El Paso, September 25-27, 1975.

Oil-water separation, Emulsions, Coalescence, Design and engineering

Pilot studies can provide useful information in the design and operation of coalescers to break stable oil-water emulsions. Treatability results from the experiments reported in this paper show how this can be accomplished by using media preferentially wetted by the dispersed phase, a minimum oil saturation of 10-15%, and a bed depth of 0.4 centimeters. Increased filter velocity and decreased interfacial tension decrease coalescence.

C-1247-77
ADVANCED WASTE WATER TREATMENT PROCESS IS EFFECTIVE
Christensen, D. R., and B. R. Conn. 1976.
Hydrocarbon Processing 55(10):107-109.

Wastewater treatment, Petrochemicals, Oil-water separation

A petrochemical plant wastewater treatment pilot study is described which consists of oil removal, two sequential biological processes, chemical treatment, filtration, and activated carbon adsorption. Treated effluent had 0-10 mg/l oil and grease, as compared to 40 mg/l for untreated effluent.

[from Chemical Abstracts 86(10):#60168w. 1977]

C-1248-77
COALESCING OIL USING A BROMINATED MONOOLEFIN RESIN
Cook, D. G. 1976.
U.S. Patent 3,992,290

Oil-water separation, Dispersions, Coalescence, Patent, *Brominated polyethylene granules

Oil dispersed in water is coalesced and separated by passing the dispersion through a bed of brominated polyethylene granules to form a coalesced floating layer which is then skimmed off.

[from Chemical Abstracts 86(16):#110879b. 1977]

C-1249-77
THE TREATMENT OF WASTE WATERS WITH PEAT MOSS
Coupal, B., and J. M. Lalancette. 1976.
Water Research 10(12):1071-1076.

Wastewater treatment, Industries, Absorption, Contaminants, *Peat moss

Industrial wastewaters containing heavy metals, certain inorganic contaminants and organic matter (including oil and detergents) can be treated effectively after initial settling by contacting with peat moss. The characteristics and performance of a contacting machine with a 75,700 l/day (20,000 gal/day) treatment capacity are described.

[from Chemical Abstracts 86(18):#126703a. 1977]

C-1250-77
MINERAL OIL WASTES; A TECHNICAL MEMORANDUM ON ARISINGS, TREATMENT AND DISPOSAL, INCLUDING A CODE OF PRACTICE
Department of the Environment. 1976.
London, Stationery Office, 1976. 28p. (Waste Management Paper No. 7)

Waste oil, Sources, Environmental effects, Reclamation, Disposal, Economic effects

"This publication outlines the origins of waste oils, and their adverse environmental effects if not properly disposed of. The economic and environmental value of recovery rather than disposal is stressed."

[from WRC Information 3(43):#76-2975M. 1976]

C-1251-77
FLOTATION COMBINED WITH OZONATION FOR REMOVAL OF OIL AND DISSOLVED ORGANIC SUBSTANCES FROM REFINERY WASTE WATERS [in German]
Dietrich, K. R. 1976.
Gesundheits-Ingenieur 97(9):209-211.

Wastewater treatment, Refineries, Oil-water separation, Flocculation, Flotation, Coalescence, *Ozonation

A process for treating refinery wastewaters is described which removes oil by flocculation, flotation and coalescence, and decreases the COD of wastewater by ozonation of the organic matter.

[from Chemical Abstracts 86(14):#95448q. 1977]

C-1252-77
TREATMENT OF WASTE WATERS AFTER EMULSION DEGREASING OF MOTOR PARTS.
Dvorak, J., J. Sedivy, H. Hofmanova, and J. Hezina. 1976.
Czechoslovakian Patent 163,896

Wastewater treatment, Fuels, Emulsions, Oil-water separation, Patent

Spent emulsions containing motor fuels and greases are treated with an 8% aqueous solution of NaC_{12-14}-alkylbenzenesulfonate to break the hydrocarbons and water into separate phases.

[from Chemical Abstracts 86(14):#95627x. 1977]

C-1253-77
WEMCO HYDROCLEANER FLOTATION MACHINE (product information)
Envirotech/WEMCO. n.d.
Envirotech/WEMCO, P.O. Box 15619, Sacramento, CA 95813.
Bulletin F9-B2.

Oil-water separation, Flotation, Design and engineering, *Aeration, *WEMCO Hydrocleaner

An air flotation machine for oil-water separation is available which features a hydraulically powered aeration system that has no moving parts, weighs considerably less, and consumes less power than other wastewater systems of comparable capacity. Used with the proper chemical reagents, the system works with a broad range of light to heavy oils and petroleum products, leaving an effluent of typically less than 10 ppm hydrocarbons. The units are available in 200-20,000 l/min (50-5000 gal/min) capacities.

C-1254-77
COLLECTION AND TRANSPORT OF OIL WASTE AND WASTE HARMFUL TO THE ENVIRONMENT
Eriksson, S. E. [1976?]
International Trade Fair on Waste Handling, Recycling and Industrial Cleansing, [1976?]. Paper K6. 8p.

Waste oil treatment, Disposal, *Waste management

Working relationships, agreements, and cooperation between an independent waste management organization and area authorities are detailed. The responsibilities of both organizations are described.

[from Pollution Abstracts 8(2):#77-01941. 1977]

C-1255-77
OILY WASTES HANDLING AND DISPOSAL - U.S. NAVY
Ferraro, J. M., S. M. Fruh, A. R. Garabrant, P. M. Nadeau, and R. V. Thomas. 1976.
Naval Engineers Journal 88(2):131-137.

Waste oil treatment, Reclamation, Disposal, USN

The development of abatement and control programs for 17 naval facilities on U.S. and foreign soils is described. The first step taken was a plan to minimize through procedural changes the volume of wastes actually generated. The means were determined for each facility to reclaim, destroy, or dispose of wastes by effective and legal methods.

[from Oceanic Abstracts 14(2):#77-01622. 1977]

C-1256-77

PROCESS FOR SEPARATING OIL FROM WATER AND APPARATUS FOR IMPLEMENTING THE PROCESS

Forssberg, K. S. E., and K. D. Kopp. 1976.
French Patent 2,307,563

Oil-water separation, Filtration, Design and engineering, Patent

A mixture of oil and water passes through a filter containing hematite or magnetite with particle dimensions 0.2 to 1.2 mm in size. The particles are coated with a layer of a lipophilic compound. The oil clings to the particles while the water passess through the filter.

[from Petroleum Abstracts 17(13):#231,881. 1977]

C-1257-77

CELL HAVING CATALYTIC LAYER FOR COALESCING OIL DROPLETS

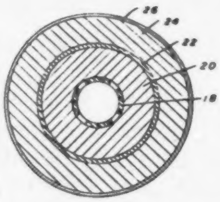
Fowler, L. L. 1976.
U.S. Patent 3,980,565

Oil-water separation, Emulsions, Coalescence, Design and engineering, Patent, *Metal catalysts

A cell for oil-water separation of emulsions is described which involves a catalyst for enhancing the coalescence of finely dispersed oil droplets. The device is comprised of an elongated, perforated core filled with emulsion-breaking fibrous material surrounded by a catalytic, porous, and flexible layer that has sprayed-on particles of the metals Ca, Sn, Al, Ni, Zn and their alloys.

[from Chemical Abstracts 86(8):#45433k. 1977]

3,980,565
CELL HAVING CATALYTIC LAYER FOR COALESCING OIL DROPLETS
Leslie L. Fowler, 1722 E. 59th St., Tulsa, Okla. 74105
Filed Nov. 26, 1971, Ser. No. 202,378
Int. Cl.^{2} B01D *27/00*
U.S. Cl. 210—489 **3 Claims**



C-1258-77

METHOD AND APPARATUS FOR CLARIFYING CONTAMINATED LIQUIDS

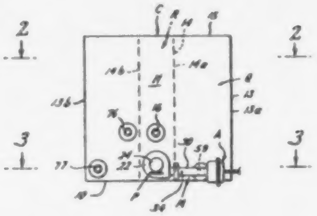
George, A. L., and J. C. Manning. 1976.
U.S. Patent 3,986,954

Wastewater treatment, Oil-water separation, Emulsions, *Aeration, Flotation, Patent

Oil-water separation is aided by decreasing the specific gravity of the suspended oil. The suspension is aerated and pumped under pressure through a small orifice into a large chamber. This procedure results in the formation of minute bubbles which adhere to the oil particles and cause them to float. The floating oil is then topped in a trough and removed; the effluent is discharged or recirculated for further oil-water separation.

[from Chemical Abstracts 86(12):#78272k. 1977]

3,986,954
METHOD AND APPARATUS FOR CLARIFYING CONTAMINATED LIQUIDS
Albert L. George, and Jerry C. Manning, both of Lafayette, La., assignors to Al George, Inc.
Filed May 19, 1975, Ser. No. 578,424
Int. Cl.² B03D 1/24
U.S. Cl. 210—44 30 Claims



C-1259-77

USE OF COMMERCIAL-GRADE OXYGEN FOR THE BIOCHEMICAL PURIFICATION OF PETROLEUM REFINERY WASTE WATERS [in Russian]

Gerber, V. Ya., G. D. Gubanova, and E. G. Ioakimis. 1976.
Khimiya i Tekhnologiya Topliv i Masel (11):12-16.

Wastewater treatment, Refineries, Oxidation, *Oxygen aeration

Aeration with oxygen instead of air greatly increased the biochemical purification of mixed wastes in petroleum refinery wastewaters.

[from Chemical Abstracts 86(14):#95475w. 1977]

C-1260-77
APPARATUS AND METHOD FOR BREAKING AND TREATING STABLE EMULSIONS
Ghisalberti, F. 1976.
German Offenlegungsschriften (unexamined patent application) 2,623,439

Emulsions, Oil-water separation, Coagulation, Filtration, Patent

A three-compartment apparatus is used to separate stable emulsions into oil and water. In the first compartment the emulsion is coagulated by electrolysis; from there it moves to the bottom of a compartment with an inverted cone shape and then travels upward and into a sand filtration unit. The third compartment is a trough which collects the clarified water.

[from Chemical Abstracts 86(16):#110890y. 1977]

C-1261-77
REFINERY EFFLUENT IMPROVED BY GRAVITY-PRESSURE DEWATERING
Grimes, C. B. 1977.
Oil and Gas Journal 75(17):106-108.

Sludge, Refineries, Wastewater treatment, Disposal, *Sludge dewatering

Refinery sludge is efficiently and economically prepared for landfill disposal by a combination gravity filtration-pressure dewatering process. The method cuts sludge volume by 80-90%, thereby significantly decreasing the cost of the final sludge disposal.

C-1262-77
REMOVAL OF PETROLEUM PRODUCTS FROM THE ACTIVATED SLUDGE SYSTEM [English summary]
Grunwald, A. 1976.
Sbornik Vysoke Skoly Chemicko - Technologicke Praze, Technologie Vody F20:53-84.

Waste oil treatment, Petroleum products, Activated sludge

"Activated sludge was acclimated to mineral oils (e.g., gasoline, crude oil, and grease) using a substrate containing peptone 0.8, d-glucose 0.8, $NaHCO_3$ 1.0, and KH_2PO_4 0.04g in 1L potable water and then used in batch treatment of the hydrocarbons (aeration 2 days at 0.4 L/min at 20°, sludge age 5 days)."

[from Chemical Abstracts 86(14):#95563y. 1977]

C-1263-77
TREATMENT FOR THE PURIFICATION OF EFFLUENTS FROM OIL-WELL DRILLING OPERATIONS
Guillerme, M., J. Gratacos, A. Sirvins, and B. Tramier. 1976.
French Patent 2,301,680

Oil wells, Drilling, Wastewater treatment, Biodegradation, Bacteria, Flocculation, Patent

Certain strains of biodegrading bacteria are applied to oil well drilling effluents in order to lower the biological oxygen demand to required limits. This treatment is followed by conventional flocculation processes and the resultant effluent meets existing oil drilling wastewater discharge regulations.

[from Petroleum Abstracts 17(15):#232,181. 1977]

C-1264-77
OILY BILGE WATER TREATMENT WITH A TUBULAR ULTRAFILTRATION SYSTEM
Harris, L. R., et al. 1976.
Journal of Engineering for Industry 98:1215-20.

Wastewater treatment, Bilges, Oil-water separation, Filtration, *Tubular ultrafiltration system

A tubular ultrafiltration system using cellulosic and noncellulosic membranes was tested with bilges and other oily wastes, alone and combined with a nonionic detergent. Detergent addition resulted in a steeper flux decline than any of the fluids evaluated alone. Both membrane types produced a permeate with an oil content < 15 mg/l. The noncellulosic membranes exhibited higher flux rates than the cellulosic membranes; only the former could be restored to its initial water flux by a cleaning operation.

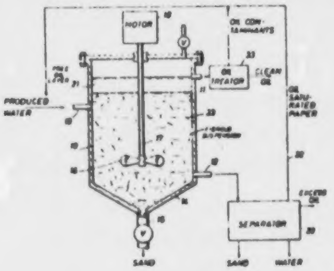
C-1265-77
CONTINUOUSLY SEPARATING EMULSIONS
Herce, J. A., and J. E. Heath. 1976.
U.S. Patent 3,996,157

Wastewater treatment, Emulsions, Oil-water separation, *Cellulose fibers, Patent

Waste oil-water emulsions are treated with a liquid suspension of nongranular, discrete, 100-10,000 μ cellulose fibers to yield a continuous phase and an essentially fiber-free dispersed phase. The demulsified oil can be recovered, the effluent water contains only 3-4 ppm oil, and the fibers can be recycled.

[from Chemical Abstracts 86(12):#78280m. 1977]

3,996,157
METHOD FOR CONTINUOUSLY SEPARATING EMULSIONS
John A. Herce, Bellaire, and James E. Heath, Houston, both of Tex., assignors to Shell Oil Company, Houston, Tex.
Division of Ser. No. 271,441, July 13, 1972, Pat. No. 3,869,408. This application July 18, 1974, Ser. No. 489,678
Int. Cl.^{2} B01D *15/02*
U.S. Cl. 252--325 28 Claims


MOTOR
OIL CONTAMINANTS
33
OIL TREATOR
CLEAN OIL
11
OIL SATURATED PAPER
PRODUCED WATER
SEPARATOR
EXCESS OIL
SAND
SAND
WATER

C-1266-77

APPARATUS AND METHOD FOR TREATING A STREAM OF OIL-CONTAINING WASTE WATER USING ULTRAFILTRATION

(Hoogovens Ijmuiden B. V.) 1976.
Netherlands Application 75 05,875

Emulsions, Wastewater treatment, Filtration, pH control, Design and engineering, Patent

Oily wastewater emulsions are separated by ultrafiltration after adjustment to pH 10. The apparatus which utilizes this process to treat a continuous waste stream is described.

[from Chemical Abstracts 86(18):#126814y. 1977]

C-1267-77

SEPARATION OF OIL AND WATER

Iizuka, K., N. Daimon, S. Ichinose, T. Kiribayashi, and M. Murata. 1976.
Japanese Kokai (unexamined patent application) 76,136,591

Wastewater treatment, Oil-water separation, Flotation, Patent, *Powdered mica

Treatment of tetrasilicic mica ($NaMg_{2.5}Si_4P_{10}F_2$) with alkylbenzyldimethylammonium chloride in BuOH removes oil from water. In an example, water containing 5000 ppm heavy oil was flotated with 0.25% mica, yielding an effluent with 482 ppm oil.

[from Chemical Abstracts 86(20):#145327x. 1977]

C-1268-77

MANAGEMENT OF OIL SLUDGE FROM A REFINERY WASTEWATER TREATMENT PLANT

Ioakimis, E. G., and A. D. Davletov. 1975.
USA/USSR Symposium on Handling, Treatment and Disposal of Wastewater Sludge, Moscow, 1975. p.27-35.

Wastewater treatment, Sludge, Refineries, Incineration, USSR

Several months of incineration of oil sludge produced by refinery and petrochemical wastewater treatment have been tested in the USSR. Rotary drum kilns, fluid bed of heat carrier, and furnaces with bubble burners are described.

[from Environment Abstracts 6(12):#76-08157. 1977]

C-1269-77

APPARATUS FOR SEPARATING LIQUID PETROLEUM PRODUCTS FROM A MIXTURE OF LIQUID PETROLEUM PRODUCTS AND WATER

Kuenzle, B. 1976.
Swiss Patent 579,939

Emulsions, Oil-water separation, Coalescence, Filtration, Patent

Oil emulsions are separated from water by means of coalescence filters connected in a cascade series operated under hydrostatic pressure. Each of the successive filters is fed from the bottom, and the filters are filled with poly(tetrafluoroethylene) chips as filtering layers.

[from Chemical Abstracts 86(12):#78268p. 1977]

C-1270-77
PHYSICAL-CHEMICAL TREATMENT OF WASTEWATERS FROM THE PETROLEUM REFINING - PETROCHEMICAL INDUSTRY
Lacy, W. J., and A. Cywin. 1975.
USA/USSR Symposium on Physical-Chemical Treatment [of Waste Waters] from Municipal and Industrial Sources [Papers], Taft Center, Cincinnati, November 12-14, 1975. Washington, D.C. Environmental Protection Agency, 1975. p. 35-49.

Refineries, Petrochemicals, Wastewater treatment, *Physical-chemical methods

"A review with 24 references."

[from Chemical Abstracts 86(20):#145145m. 1977]

C-1271-77
ULTIMATE DISPOSAL OF OIL AND HAZARDOUS MATERIALS
Leary, J. F. 1975.
Final feasibility study, No. USCG-D-36-76. 68p.

Waste oil disposal, Spill disposal, Cost analysis, Storage, USCG

The state of the art of methods to store and/or dispose of recovered oil and other hazardous chemicals which are discharged into U.S. inland and coastal waters is investigated. The Ultimate Disposal problem is discussed with emphasis on the need to establish the most cost effective and environmentally suitable Ultimate Disposal System to satisfy the Coast Guard's needs.

[from Government Reports Announcements 77(8):#AD-A035 137/9GA. 1977]

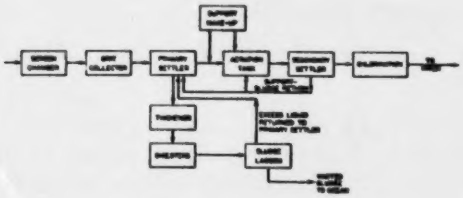
C-1272-77
METHOD OF TREATING WASTE WATER
Liles, A. W., and R. D. Schwartz. 1976.
U.S. Patent 3,968,036

Wastewater treatment, Refineries, Activated sludge, Oxidation, Patent

A process is described for treating refinery wastewater by contacting the wastewater with an activated sludge at conditions under which biological oxidation takes place. Various water-insoluble inorganic oxides consisting of silica, alumina, and silica-alumina are combined with the sludge, thereby increasing the rates of biological oxidation and sludge settling.

[from How to Remove Pollutants and Toxic Materials from Air and Water. M. Sittig (ed.). New Jersey, Noyes Data Corporation, 1977. p.410-411]

3,968,036
METHOD OF TREATING WASTE WATER
Arthur W. Liles, Murray Hill, and Robert D. Schwartz, East Windsor, both of N.J., assignors to Exxon Research and Engineering Company, Linden, N.J.
Filed June 17, 1974, Ser. No. 480,011
Int. Cl.^{2} C02C *1/20*
U.S. Cl. 210—15 **2 Claims**



C-1273-77

BREAKING EMULSIONS IN NAVY BILGE COLLECTION AND TREATMENT SYSTEMS
Little, R. C., and R. L. Patterson. 1976.
Report NRL-MR-3424. 56p.

Bilges, Ships, Wastewater treatment, Emulsions, Oil-water separation, *Demulsification

A new bilge waste collection and treatment system is described which is especially suitable for breaking stable oily waste emulsions into their constituent phases. The system utilizes chemical demulsifiers such as certain quaternary ammonium compounds because they are effective over a wide range of temperatures and oil concentrations.

[from Government Reports Announcements 77(5):#AD-A033 649/5GA. 1977]

C-1274-77
HIGH EFFICIENCY OIL/WATER SEPARATION
Lock, J. E. 1976.
Processing 22(10):41.

Oil-water separation, Coalescence, Design and engineering

A single system oil coalescence process is described which can remove oil droplets > 10 μ in diameter with nearly 100% efficiency to < 1 ppm concentrations, and oil droplets < 10 μ with 30-60% efficiency to < 5 ppm.

[from Pollution Abstracts 8(2):#77-01232. 1977]

C-1275-77
COALESCING WITH SURFACE-PURIFIED PARTICLES
Mail, I. 1976.
Canadian Patent 990,218

Oil-water separation, Hydrocarbons, Dispersions, Coalescence, Patent

A process for separating small quantities of finely dispersed particles of hydrocarbons from water is described. The process involves passing the oil-in-water mixture through a bed of activated carbon particles which absorbs the hydrocarbons. The hydrocarbons then coalesce into particles of large enough size for conventional oil-water separation.

[from Chemical Abstracts 86(12):#75251s. 1977]

C-1276-77
FLUIDIZED BED REACTORS EASE PROBLEMS
Mayrose, D. T. 1976.
Water and Wastes Engineering 13(10):56-58,60.

Sludge, Solid wastes, Disposal, Incineration, Cost analysis, Design and engineering

The use of fluid bed reactors in sludge handling and solid waste disposal is discussed and is compared to other methods of waste treatment. The design and operation of a fluid bed incinerator are described and cost benefits are analyzed. Fluid bed reactors are considered to be efficient and inexpensive methods for the disposal of waste solids and sludge.

C-1277-77
PURIFICATION OF OIL-CONTAINING WASTE WATER
(Mitsui Toatsu Chemicals, Inc.) 1975.
Netherlands Application 75 02,522

Wastewater treatment, Fuel oil, Hydrocarbons, Flocculation, pH control, Patent

"Fuel oil or hydrocarbons are removed from wastewater by flocculation by adding a thermo-setting, water-soluble phenol-formaldehyde condensation product (mol. wt 120-5000) and adjusting the pH to 7."

[from Chemical Abstracts 86(18):#126795g. 1977]

C-1278-77
APPARATUS FOR SEPARATING AND ANALYZING MEDIA WITH DIFFERENT PHASES
Muennich-Debus, H. 1976.
German Offenlegungsschriften (unexamined patent application) 2,519,701

Oil-water separation, Design and engineering, Patent

Oil on water is separated in a tank which has a basal water outlet and is equipped with an upper and lower oil sensor. As the tank is filled, the rising oil-water interface arrives at the upper sensor, the oil overflows, and the basal water outlet opens. When the oil layer drops to the lower sensor level, the water outlet closes and the cycle repeats.

[from Chemical Abstracts 86(20):#142074b. 1977]

C-1279-77
SCIENTIFIC-TECHNICAL PROGRESS AND IMPROVEMENT OF THE SANITARY STATE OF WATER BODIES IN THE REGIONS OF OIL-REFINING AND OIL CHEMICAL ENTERPRISES [English summary]
Murzakaev, F. G., and A. A. Mingazetdinov. 1976.
Hygiene and Sanitation 7:7-10.

Waste oil, Petroleum products, Petrochemicals, Contamination, Refining, Rivers, USSR

Observational data show the oil refining and oil chemical enterprises in Bashkirya to have carried out technological, sanitary-technical, and organizational measures to decrease oil and oil product contamination of the Belaya River.

[from Applied Ecology Abstracts 3(3):#3D3054. 1977]

C-1280-77

PURIFICATION OF WASTE WATERS AT PLANTS OF THE "GROZNEFTEORGSINTEZ" ASSOCIATION [in Russian]
Musaev, D. D., and E. F. Slyadnev. 1976.
Khimiya i Tekhnologiya Topliv i Masel (11):5-7.

Refineries, Petrochemicals, Wastewater treatment, *Biochemical purification

"The biochemical purification of the petroleum refining and petrochemical wastes was improved by reducing the amount and improving the quality of the separated wastewaters. The BOD of the purified waters was brought to that of fresh river water."

[from Chemical Abstracts 86(14):#95473u. 1977]

C-1281-77

SEPARATION OF OIL AND WATER
Nagata, E., H. Iwamoto, and M. Kobayashi. 1976.
Japanese Kokai (unexamined patent application) 76,111,493

Oil-water separation, Emulsions, Coalescence, Flotation, Patent, *Magnetic powder

Emulsified oil is separated from water by stirring in magnetic powder, permitting the powder to coalesce and float, and then filtering the liquid through steel wool.

[from Chemical Abstracts 86(18):#126796h. 1977]

C-1282-77

PURIFICATION OF PETROCHEMICAL INDUSTRY WASTE WATERS [in Russian]
Nemchenko, A. G., L. M. Samoilova, O. V. Mamontova, E. V. Rubinskaya, and V. L. Vainer. 1976.
Khimiya i Tekhnologiya Topliv i Masel (11):23-26.

Wastewater treatment, Aromatic hydrocarbons, Petrochemicals, Absorption

Desorption-absorption was used to remove aromatic hydrocarbons from the wastewater. Biological treatment, ozonation, and reverse osmosis were used to destroy or remove other organic and inorganic contaminants.

[from Chemical Abstracts 86(14):#95479a. 1977]

C-1283-77

COMPOSITION FOR THE REMOVAL OF PETROLEUM FROM THE SURFACE OF WATER
Nesterova, M. P., and N. M. Anufrieva. 1977.
USSR Patent 542,730

Wastewater treatment, Oil slicks, Spill recovery, Absorption, Patent, *Polyurethane

Floating oil can be removed from the surface of water by a composition containing 97.5-99.0% by weight polyurethane and 1.0-2.5% by weight Et_3N.

[from Chemical Abstracts 86(20):#145324u. 1977]

C-1284-77

DETERMINATION OF PETROCHEMICAL PRODUCTS IN WASTE WATERS [English summary]
Novak, J., and I. Viden. 1976.
Sbornik Vysoke Skoly Chemicko - Technologicke v Praze, Technologie Paliv D33:353-366.

"Wastewater containing 20-500 mg/L petrochemical products was filtered through a 1 × 18 cm column packed with divinyl - styrene resin (Sinachrom E). The adsorption capacity of the column was C_6H_5N 65,cresol 207, quinoline 341, 2,6-dichlorophenol 402, toluene 900, xylene 1780 mg. Elution was done with MeOH."

[from Chemical Abstracts 86(20):#145260v. 1977]

C-1285-77

THE USE OF POLYURETHANE FOAM AS FILTER MATERIAL DURING THE PURIFICATION OF PETROLEUM-CONTAINING WASTE WATERS. [in Russian]
Oboznyi, V. F., I. D. Pichakhchi, and V. V. Shimkovich. 1976.
Khimiya i Tekhnologiya Topliv i Masel (11):26-28.

Wastewater treatment, Filtration, *Polyurethane foam

Wastewaters filtered through a 1.5 m thick bed of polyurethane flakes (5-30 mm) at 30 m/hr reduced the petroleum contents from 100-500 mg/l to 5-25 mg/l. The filtered water contained 3-18 mg colloidal and dissolved petroleum products per liter.

[from Chemical Abstracts 86(16):#110751d. 1977]

C-1286-77
EXAMINATION OF OIL-CONTAINING WASTE WATERS CHEMICAL COMPOSITION AFTER THEIR TREATMENT IN AERATION TANKS
Panova, V. A., N. S. Goryachev, and Yu. Yu. Lur'e. 1975.
USA/USSR Symposium on Physical-Chemical Treatment [of Waste Waters] from Municipal and Industrial Sources [Papers], Taft Center, Cincinnati, November 12-14, 1975. Washington D.C., Environmental Protection Agency, 1975. p.90-95.

Wastewater treatment, Chemical analysis, Hydrocarbons, Oxidation, Toxicity, *Aeration

Analysis of wastewaters following biological and biochemical treatment and aeration was conducted. Biologically treated wastewater retains about 10-15% of initially present hydrocarbons and these are mainly $C_{>14}$ hydrocarbons. Biochemical treatment of oily wastewaters results in deep chemical changes of hydrocarbons. Many of these are in the form of intermediate products of different degrees of oxidation and are responsible for the toxicity of such wastewaters.

[from Chemical Abstracts 86(20):#145239v. 1977]

C-1287-77
TREATMENT OF CONCENTRATED WASTE WATERS CONTAINING OIL EMULSIONS
Ponomarev, V. G., and S. B. Zakharina. 1975.
USA/USSR Symposium on Physical-Chemical Treatment [of Waste Waters] from Municipal and Industrial Sources [Papers], Taft Center, Cincinnati, November, 12-14, 1975. Washington D.C. Environmental Protection Agency, 1975. p.120-123.

Emulsions, Wastewater treatment, Sludge, pH control, Flotation, Coagulation, *Aeration

Waste emulsion is introduced into a settling tank and the pH is adjusted to 6-7 with H_2SO_4. Floated oil is collected and sludge is retained in a holding tank. The remaining emulsion is fed to the flotation unit for a second treatment in which a coagulant is added. The mixture is then aerated to saturation and the floated oil foam is collected and disposed.

[from Chemical Abstracts 86(20):#145241q. 1977]

C-1288-77
HOW TO DISPOSE OF TOXIC SUBSTANCES AND INDUSTRIAL WASTES
Powers, P. W. 1976.
Environmental Technology Handbook No. 4. Park Ridge, New Jersey, Noyes Data Corporation, 1976. 497p.

Disposal, Wastewater, Solid wastes, Industries, Oil industry

This book is concerned with the disposal of liquid and solid wastes and sludges from industrial operations by such methods as incineration, dispersal into water, dumping at sea, lagooning, landfill or tipping, and underground disposal. Among the various topics and industries covered are deep well disposal of effluents in the petrochemical industry and problems encountered by the petroleum industry in removing oil, dissolved organic residues and sludges during wastewater treatment processes.

[from Marine Pollution Bulletin 8(4):95. 1977]

C-1289-77
REFINERY EFFLUENT SOURCES, CONSTITUENTS AND TREATMENTS
Roberts, W. G. 1976.
Marine Ecology and Oil Pollution. J. M. Baker (ed.). New York, John Wiley & Sons, 1976. p. 191-200. Institute of Petroleum/ Field Studies Council Meeting, Aviemore, Scotland, 1975.

Wastewaters, Refineries, Sources, Wastewater treatment, Activated sludge, *Oxidation lagoons, *Activated carbon

Pollution arising at oil refineries, in particular the effluent water, is discussed and the sources are identified. Wastewater treatment techniques for pollutants are described and include activated sludge systems, oxidation lagoons, and activated carbon treatment.

C-1290-77
ASSESSMENT OF HAZARDOUS WASTE PRACTICES IN THE PETROLEUM REFINING INDUSTRY
Rosenberg, D. G., R. J. Lofy, H. Cruse, E. Weisberg, and B. Beutler. 1976.
Pasadena, CA, Jacobs Engineering Co., 1976. 369p. PB-259 097/4WE.

Wastewater treatment, Disposal, Refineries, Chemical analysis, Contaminants

The report is a comprehensive review of hazardous waste generation and management practice in the petroleum refining industry. Waste streams emanating from individual refining process sources are characterized and described in detail. A laboratory program of chemical analysis was carried out to identify potentially hazardous refinery waste constituents based on site visits and waste stream sampling at a representative group of 16 refineries. Oil is the principal hazardous component, followed by fluoride, metal constituents, and phenol, cyanide and benz-a-pyrene. Refinery waste disposal methods and waste recycling are also discussed.

[from Energy Review 20:23. 1977]

C-1291-77
SEPARATION OF HYDROCARBONS FROM AQUEOUS SOLUTIONS
Schulze, G. 1976.
German Offenlegungsschriften (unexamined patent application)
2,513,353

Wastewater treatment, Oil-water separation, Emulsions, Oxidation, Patent

Hydrocarbons and oil emulsions are removed from neutralized wastewaters by aeration with a stoichiometric excess of oxidant. Details of a sample oil-water separation which yielded an effluent containing 16 mg oil/l are presented.

[from Chemical Abstracts 86(12):#78267n. 1977]

C-1292-77
REGENERATION OF FIBROUS BED COALESCERS FOR OIL-WATER SEPARATION
Shah, B., W. Langdon, and D. Wasen. 1977.
Environmental Science and Technology 11(2):167-170.

Oil-water separation, Coalescence, Emulsions, *Fibrous bed coalescers

The regeneration of fibrous bed coalescers operating on secondary oil-in-water emulsions was studied. Glass fibers were bound together or stabilized by application of isobutyl methacrylate resin and were subsequently heat treated. The efficiency of these coalescers was close to 100% and cyclic life was about six hours. Steam was an efficient regenerating agent and gave cycle lives 0.8 times that of fresh bed.

C-1293-77
USE OF OZONE FOR THE PURIFICATION AND ADDITIONAL PURIFICATION OF PETROLEUM REFINERY WASTE WATERS [in Russian]
Sharifov, R. R. 1976.
Khimiya i Tekhnologiya Topliv i Masel (11):20-23.

Wastewater treatment, Refineries, *Ozone aeration, *Biochemical purification

Residual organic compounds left after biochemical purification were further decreased by ozone aeration.

[from Chemical Abstracts 86(14):#95478z. 1977]

C-1294-77
WATER CONSIDERATIONS FOR ALBERTA OIL SANDS DEVELOPMENTS
Shewchuck, P. G. 1975.
Proceedings of the National Conference on Complete Water Use, 2nd, Chicago, Illinois, 1975. p.155-158.

Tar sands, Development, Wastewater disposal, Water quality, Canada

Water is of primary concern in the development of oil sands resources of Alberta. The availability of sufficient quantities of water, the volumes and quantities of wastewater, and the management and environmentally safe disposal of process wastewaters are discussed.

[from The Engineering Index Monthly 15(2):#011587. 1977]

C-1295-77
SEPARATING AGENT FOR OIL AND WATER
Shioda, H., and T. Osanai. 1976.
Japanese Kokai (unexamined patent application) 76 97,589

Oil-water separation, Patent, *Polypropylene foam

"Polypropylene foam containing bismuth titanium oxide ($BiTiO_3$) is used for separating oils from water."

[from Chemical Abstracts 86(8):#47113e. 1977]

C-1296-77
TREATMENT OF PETROLEUM-POLLUTED WASTE WATERS IN A SYSTEM USING HYDRAULIC ASH-AIDED AT HEATING AND POWER PLANTS [in Russian]
Shvetsova, V. P., V. A. Kopein, and Z. I. Krasnopevtseva. 1977.
Energetik (1):11-13.

Wastewater treatment, Absorption, *Coal ash

"The oil content in wastewaters is reduced by filtration through the active C BALL whose sorption capacity is 0.8 - 0.9 g oil/g. Ash from Chelyabinsk coal absorbs 0.7 - 0.8 g oil/g. A 30 minute contact period between wastewaters containing 75-100 mg oil/L and coal-ash hydrosol reduced the oil content in the water to 3.2 mg/L. The sorption capacity of the Chelyabinsk coal ash was not diminished after 20 cycles."

[from Chemical Abstracts 86(20):#145231m. 1977]

C-1297-77
WASSERHAUSHALT EINER RAFFINERIE [WATER BUDGET OF A REFINERY] [in German]
Siebert, M. 1976.
Literaturberichte über Wasser, Abwasser, Luft und Feste Abfallstoffe 24(2):134.

Refineries, Wastewater treatment, Recycling, Oil-water separation, Sludge, West Germany

The water cycle of the Woerth, West Germany oil refinery is described. All process wastewaters are partially treated and recycled for use within the refinery. Wastewater treatment processes including oil and sludge separation are adequate to meet July, 1977, EPA specifications.

[from Pollution Abstracts 8(3):#77-02496. 1977]

C-1298-77
HOW TO REMOVE POLLUTANTS AND TOXIC MATERIALS FROM AIR AND WATER
Sittig, M. (ed.). 1977.
New Jersey, Noyes Data Corporation, 1977. 621p.

Wastewater treatment, Pollution control, Industries, Refineries, Spill cleanup, Patent

This text provides surveys of some 500 patents dealing with environmental control systems in the 1973 to 1976 period. Refinery effluents are covered in detail; and oil spills, industrial effluents, chemical pollutants, and metal toxicants are also included.

C-1299-77
HEAVY-EMULSION OIL WASTE REDUCED FROM 2000 TO 10 PPM
Smith, A. W., and K. Robe. 1976.
Chemical Processing 39(12):62.

Wastewater treatment, Refineries, Emulsions, Oil-water separation, Flotation, Skimmers

A process is described for treating petroleum refinery wastewater containing an average of 2000 ppm oil and reducing residual oil to 10 ppm. The process includes air flotation, an oil-water separator box, surface skimming and chemical treatment.

[from Pollution Abstracts 8(2):#77-01493. 1977]

C-1300-77

THE USE OF MODIFIED FORMS OF PEAT AS AN OIL COALESCER

Smith, E. F., and H. B. Mark. Jr. 1977.
Journal of Environmental Science and Health 11A(12):727-734.

Wastewater treatment, Oil-water separation, Emulsions, Bilges, Coalescence, *Peat

Dried and sulfuric acid-treated peat was shown to effectively remove ± 90% of oil in ± 250 ppm oil-in-water emulsions. The coalescence capability of peat matched that of XAD-2 polystyrene beads. Cartridges of peat could be useful in shipboard bilgewater filtration as they are less susceptible to plugging by solids and are very inexpensive.

[from Pollution Abstracts 8(3):#77-02423. 1977]

C-1301-77

ACID PRETREATMENT OF PETROLEUM SLUDGES FORMING DURING FLOTATION OF PETROLEUM REFINERY WASTE WATER [in Russian]

Sokolov, V., L. Chikunova, and G. Molchanov. 1976.
Neftyanik (9):21.

Wastewater treatment, Refineries, Sludge, *Acid pretreatment

Petroleum sludge was allowed to settle for 2-4 hours, then acidified to pH 1.25-2.85 with H_2SO_4. This procedure removes the petroleum and other impurities from the sludge and greatly decreases the volume of the sludge.

[from Chemical Abstracts 86(18):#126628e. 1977]

C-1302-77

ELECTROFLOTATION METHOD FOR OIL REMOVAL FROM INDUSTRIAL EFFLUENTS [in Polish]

Stelmach, K., and K. Wisniewski. 1976.
Metochy Fyzikochemiczne Oczyzczania Wod i Sciekow Referaty z Konferencji Naukowo Technicznej Lublin (2):126-132.

Wastewater treatment, *Electroflotation, Oil-water separation, Coagulation

Electroflotation, along with simultaneous electrocoagulation in two electrolyzers, was used to achieve an oil removal of 93-95%. Current intensity used in the processes affected the treatment. Used alone, the treatment resulted in an effluent with an oil content of 10 mg/dm^3. When used in conjunction with filtration and flocculation, the treatment resulted in an oil content of 0.7 mg/dm^3.

[from Chemical Abstracts 86(16):#110842j. 1977]

C-1303-77
REMOVING OIL FROM OILY WASTE WATER STREAMS
Vadekar, M., and H. S. Wilson.
U.S. Patent 4,008,160

Wastewater treatment, Oil-water separation, Emulsions, Refineries, Patent, *Polyvinyl chloride

Oily wastewaters, especially stable emulsions from refineries, are effectively treated by passing the stream over a particulate bed of unprocessed polyvinyl chloride. In an example, refinery wastewaters containing 1250 ppm highly olefinic emulsified oil were passed through polyvinyl chloride, removing > 99% of the oil as compared to 60% using activated carbon.

[from Chemical Abstracts 86(20):#145331u. 1977]

C-1304-77
COMPUTER SUPERVISION OF USED OIL EMISSION [in German]
Weber, H. 1975.
Zeitschrift Binnenschiffahrt Wasserstr. 102(9):331-332.

Waste oil disposal, Bilges, Monitoring, Tankers, Rhine River, *Computer surveillance

A computer-assisted surveillance program is keeping track of all waste oil handed over to special waste oil collection tankers deployed on the Rhine and neighboring canals. The tankers are equipped with oil-water separators for processing used oil and bilges. Data on frequency and quantity of oil collected by each of the tankers from each ship is available to the appropriate supervisory agencies.

[from Environmental Health and Pollution Control 11(1):#71. 1977]

C-1305-77
HANDLING DISCHARGES FROM WASTE OIL PROCESSING, PART 2
Weinstein, N. J., and R. M. Wolfertz. 1976.
Industrial Wastes (Chicago) 22(6):26-30.

Waste oil, Recycling, Oil-water separation, Disposal, Sludge

Wastewaters from a re-refining facility and a marine waste oil processing plant were sampled and analyzed to determine possible pollution problems of waste oil recycling. The oil-water separation units and oil recovery systems are described, and the disposal of acid sludge from re-refining is discussed.

[from Chemical Abstracts 86(16):#110795w. 1977]

C-1306-77
SEPARATION OF WATER-OIL EMULSIONS
Wilms, H. 1976.
German Offenlegungsschriften (unexamined patent application)
2,503,350

Wastewater treatment, Emulsions, Oil-water separation, pH control, Flotation, Patent

Oil-in-water emulsions are broken by introducing the emulsion into a tank where pH is controlled and an emulsion-breaking reagent is added. Bubbling air through the tank separates oil at the top and it is removed from the surface with rotating disk devices.

[from Chemical Abstracts 86(8):#47102a. 1977]

C-1307-77
USE OF ELECTRIC STEEL-MELTING SLAGS FOR TREATMENT OF ACIDIC AND OIL CONTAINING WASTE WATERS [in Russian]
Yuzhaninov, A. G., A. N. Lapkin, and Yu. V. Lapkina. 1976.
Trudy Ural'skogo Nauchno-Issledovatel'skogo Instituta Chernykh Metallov 25:146-150.

Wastewater treatment, Absorption, Filtration, *Powdered steel-melting slag.

Powdered slag absorbs oil at the rate 0.8-1.1 g/g. Under laboratory conditions oil content in wastewater was reduced from 500 to 8-10 mg/l using powdered slag. The slag containing absorbed oil is easily filtered.

[from Chemical Abstracts 86(20):#145230k. 1977]

6. RECLAMATION AND REUSE

C-1308-77
DATA SHEET FEATURES OIL RECLAMATION SYSTEMS (product information)
Anon. 1977.
Hydrocarbon Processing 56(2):178.

Reclamation, Waste oil, Industries, Design and engineering

A new data sheet presents applications and design features of 1100 l/hr and 2300 l/hr (300 and 600 gal/hr) oil reclamation systems built to cycle a wide range of industrial oils. The information sheet which features the Petro Clar PI-1010 Series oil reclamation systems is available from Velcon Filters Inc., 1750 Rogers Ave., San Jose, CA 95112.

C-1309-77
VOL. 5 ENERGY FROM SOLID WASTES
Cheremisinoff, P. N., and A. C. Morresi. 1976.
Pollution Engineering and Technology. R. A. Young and P. N. Cheremisinoff (eds.). New York, Marcel Dekker, Inc., 1976. 520p.

Waste oil treatment, Solid wastes, *Energy sources

The use of solid waste products as a source of energy is described with reference to successful recovery systems presently in use in Europe, North America, and Japan. Energy from waste oil is discussed in the chapter entitled "Waste Oil Availability and Treatment Processes."

[from Marcel Dekker, Inc., publications announcement brochure. 1977]

C-1310-77
TREATMENT OF WASTE LUBRICATING OIL USING BERC/ERDA SOLVENT
Corlew, J. S., and R. J. Sluski. 1976.
Report, BERC/RI-76/11, Contract PO-BE-76-P-1601. 47p.

Waste oil treatment, Lubricating oil, Reclamation, *BERC/ERDA solvent

From data obtained in laboratory studies, a quality rerefined oil can be produced via BERC/ERDA solvent extraction and clay treatment. Yields of 75% water-distillate-free oil were produced in pilot plant operations. The BERC/ERDA system produces a marketable sludge.

[from ERDA Energy Research Abstracts 2(5):#9094. 1977]

C-1311-77
RECLAIMING LUBE OILS
Friel, J. P., and P. L. Hammond. 1976.
U.S. Patent 3,985,642

Reclamation, Lubricating oil, Surfactants, Patent

A process for reclaiming spent lubricating oil is described which consists of treating the oil with 0.1-2% anionic surfactant, such as NH_4 dodecylbenzenesulfonate, in combination with a polyalkylenepolyamine.

[from Chemical Abstracts 86(20):#142716n. 1977]

C-1312-77

NEW PROCESS FOR REREFINING OF WASTE LUBRICATING OILS
Goossens, A. G., R. F. Westerduin, and A. J. Suchanek. 1976.
Erdoel, Kohle, Erdgas, Petrochemie 29(9):419.

Waste oils, Lubricating oil, Reclamation, *Rerefining process

Waste lubricating oils are rerefined by a process which includes the removal of water and light fractions from the oil, vacuum distillation, and fixed-catalyst-bed hydrofinishing of the oil distillates obtained.

[from Chemical Abstracts 86(18):#124014c. 1977]

C-1313-77

REGENERATION OF WASTE LUBRICATING OIL
Hara, K. 1976.
Japanese Kokai (unexamined patent application) 76,125,402

Waste oil, Lubricating oil, Reclamation, Filtration, Patent

Waste lubricating oils are regenerated by admixing urea (or aluminum), heating to above 140°C (or 100°C), then filtering and precipitating to remove suspended materials. Decolorization and deodorization are effected by conventional methods.

[from Chemical Abstracts 86(12):#75739g. 1977]

C-1314-77

PRACTICAL APPLICATION OF MEMBRANE TECHNIQUES OF WASTE OIL TREATMENT
Hockenberry, H. R., and J. E. Lieser. 1976.
Annual ASLE Meeting, Philadelphia, 1976. Paper 76-AM-2B-2.
5p. Preprint.

Wastewater treatment, Waste oil, Reclamation, Reuse, Fuel oil, *Membrane techniques

As a means of recovering more oil for in-plant reuse, methods for improved treatment of oily wastewaters were studied. Ultra-filtration and reverse osmosis were found to recover oils cleaner than those recovered through a typical chemical system. The recovered oil is used as a supplementary burner fuel. Additional possibilities for in-plant reuse of the oil are being studied.

[from The Engineering Index Monthly 15(3):#017914. 1977]

C-1315-77
OIL CHANGE: A REPORT ON RECYCLING USED SUMP OIL IN BRITAIN
Mackewn, J. 1976.
London, England, Friends of the Earth, Ltd., 1976. 28p.

Waste oil, Lubricating oil, Recycling, England

Between 19 to 76 million liters (5 to 20 million gallons) of waste lubricating oils are estimated to be dumped by motorists in Great Britain each year. Current practices, legislation, and issues related to the recycling of oil in England are reviewed and a proposal for generating public interest in the recycling of waste oil is outlined.

[from Energy Abstracts for Policy Analysis 3(2):#531. 1977]

C-1316-77
OIL CONSERVATION AND RECLAMATION
Majer, D. J. 1976.
Chemical Engineer No.315:757-759,764.

Waste oil, Reclamation, Conservation, Economic effects, Environmental effects, UK

Waste oil reclamation and reuse processes are discussed in light of the ecological and economic considerations of the United Kingdom and other nations. The coalescer method and vacuum process are given as means of handling oily sludges, waste emulsions, and oily water wastes. Government influence and control are recommended for further reducing oil waste.

[from Selected Water Resources Abstracts 10(9):#W77-04455. 1977]

C-1317-77
RE-REFINING OF WASTE LUBRICATION OIL: FEDERAL PERSPECTIVE
McEwen, L. B., Jr. 1976.
Resource Recovery and Energy Review 3(6):14-17.

Waste oil, Refining, Lubricating oil, Reclamation, Reuse, Government agencies

The development of the U.S. waste oil re-refining industry is reviewed from 1915 to the present, and reasons for the decline of the industry since 1960 are noted. Renewed interest in waste oil recovery has occurred in the last few years because of environmental and conservation factors. Several federal agencies, among them EPA, ERDA, and FEA, are all introducing new programs directed at the reclamation and reuse of waste oil.

[from Pollution Abstracts 8(2):#77-01608. 1977]

C-1318-77
OIL CONTAMINATED WATER RECYCLING SYSTEM
Overfield, J. L., and J. W. Richard. 1976.
Water and Wastewater Equipment Manufacturers Association Annual Industrial Pollution Control Conference, 4th, Houston, 1976. p.48-57.

Wastewater treatment, Recycling, Oil-water separation, Design and engineering

A recycling system consisting of a filter-coalescer with automatic backflush, a solids cleaner, and accessories to remove oil from contaminated water to less than 10 ppm is described.

[from Environment Abstracts 7(1):#77-00641. 1977]

C-1319-77
REGENERATION OF WASTE LUBRICATING OIL
Ueda, S. 1976.
Japanese Kokai (unexamined patent application) 76 134,701

Waste oil treatment, Lubricating oil, Reclamation, Surfactants, Flocculation, Precipitation, Patent

Particulate impurities are removed from waste lubricating oil by a process which involves admixing 0.2-10% of an anionic, nonionic, cationic and/or amphoteric surfactant to the waste oil, followed by agitation and ultrasonic treatment of 25-30 kHz. This treatment results in flocculation and precipitation of impurities.

[from Chemical Abstracts 86(14):#92979c. 1977]

C-1320-77
REFINING OF WASTE LUBE OIL TO PREPARE USABLE LUBESTOCK
Wolk, R. H. 1976.
U.S. Patent 3,980,551

Waste oil, Lubricating oil, Reclamation, Refining, Patent

Waste lubricating oils from automobile engines are reclaimed by catalytic demetallization and hydrogenation in an ebullated bed process. The liquid effluent from this process is then vacuum distilled to produce a clean lubestock and a heavy residue containing sludge and heavy metals.

[from Chemical Abstracts 86(16):#109040g. 1977]

7. PERSONNEL TRAINING AND EDUCATION

C-1321-77
NATION'S FIRST UNIVERSITY-RUN SPILL CONTROL SCHOOL UNDERWAY
Anon. 1975.
The University and the Sea 8(2):6-7.

Oil spills, Pollution control, Personnel training, *Spill control school

Summary not available.

[from Sea Grant Newsletter Index 1975:#TAMU-Z1-75-011. 1976]

8. CONTINGENCY PLANNING

C-1322-77
ORGANIZATION NECESSARY FOR MINIMIZING THE DAMAGING EFFECTS OF A MAJOR OIL SPILL
Alberts, D. A., Sr. 1976.
Water and Wastewater Equipment Manufacturers Association Annual Industrial Pollution Control Conference, 4th, Houston, 1976. p.1-24.

Contingency planning, Oil spills, Pollution prevention, Liability, *Legal responsibilities

A company-wide contingency plan which will be sufficient for major oil spills and can be adapted to any major catastrophe is presented, and organizational requirements and their implementation are described. Job descriptions of key personnel, basic requirements of an oil spill response plan, and legal responsibilities are discussed.

[from Environment Abstracts 7(1):#77-00340. 1977]

C-1323-77
OIL SPILL CLEANUP - WHAT ARE THE CAPABILITIES
Kendrick, P. J. 1977.
Journal Water Pollution Control Federation 49(5):733-744.

Contingency planning, Spill cleanup, Government agencies, Industries, *Oil spill cooperatives

The rash of oil and hazardous material spills in recent years has provided the stimulus needed to enact national oil spill contingency plans in the U.S., Canada and Great Britain; these programs are briefly reviewed. Industry oil spill cooperatives, and examples of private companies specializing in spill cleanup and related environmental protection services are also discussed.

C-1324-77
OIL AND HAZARDOUS SUBSTANCES POLLUTION CONTINGENCY PLAN
Young, J. 1976.
Report LBL-5317, Contract W-7405-eng-48. 12p.

Contingency planning, Oil discharges, Legislation, U.S., Spill cleanup, Surveillance, Design and engineering

"LBL (Lawrence Berkeley Lab) policy and procedures are given for implementing the federal water pollution policy (FWPCA 311 (b)(1)) that forbids discharge of oil or hazardous substance into or upon navigable waters of the U.S. Design, surveillance and clean-up procedures are given for both on-site and off-site spills."

[from ERDA Energy Research Abstracts 2(2):#3879. 1977]

9. PREVENTION AND CONTROL MEASURES

C-1325-77
CRUDE OIL AND POLLUTION [English summary]
Anon. 1976.
Revue Maritime 312:275-291.

Pollution prevention, Crude oil, Spill cleanup, France, *POLMAR plan

The methods and preventive measures of fighting oil spills are reviewed and the responsibile organization in France, POLMAR plan, is described A recent oil spill and the characteristics of cleanup methods used are detailed.

[from Aquatic Sciences and Fisheries Abstracts 6(12):#6Q13493. 1977]

C-1326-77
NO-LEAK STERN TUBE GLAND
Anon. 1976.
Shipbuilding and Marine Engineering International 99(1201):450.

Leakage, Ships, Pollution prevention, *Stern gear system

The Glacier-Pilgrim Coastguard stern-gear system is a fail safe sealing system with separate seals for seawater and oil; leakage from either is freely drained inboard to the bilge or a slop tank. Tests of the ability of the seal to withstand a catastrophic leak are described.

[from Oceanic Abstracts 14(2):#77-01675. 1977]

C-1327-77
AN OIL SPILL LIABILITY BILL (news brief)
Anon. 1977.
Massachusetts Audubon 16(6):9.

Oil spills, Liability, Pollution prevention, Spill cleanup, Compensation, *Congressional bill

An oil spill liability bill has been re-introduced in Congress to provide an incentive for the prevention of oil spills, to guarantee the rapid cleanup of spills, and to allow prompt compensation to those damaged by a spill.

C-1328-77
RISERLESS SHALLOW BLOWOUT-CONTROL METHOD IS SAFE AND EFFECTIVE
Beall, J. 1976.
Oil and Gas Journal 74(31):125-129.

Offshore drilling, Blowout prevention, *Riserless drilling method

A safe, effective method for controlling shallow offshore blowouts features riserless drilling and uses seawater hydrostatic pressure to assist in well control. Reacting to and controlling a blowout situation are described and illustrated.

[from Offshore Abstracts 3(6):#76-2122. 1976]

C-1329-77
ENVIRONMENTAL PROTECTION IN NORTH SEA EXPLORATION AND PRODUCTION OPERATIONS
Blaikley, D. R. 1977.
Marine Policy 1(2):143-155.

Crude oil, Fate, Environmental effects, Pollution prevention, Offshore drilling, Oil transport, Spill cleanup, North Sea

The article begins with a general review of the fate and ecological effects of crude oil spilled in the marine environment with reference to North Sea conditions. An overview of pollution prevention and control measures during offshore oil development and production operations follows. Included are precautionary measures during exploratory and production drilling, blowout prevention and control, and crude oil transport by pipelines and tankers. Problems of spill cleanup and containment in the North Sea environment are outlined.

C-1330-77
EXPERIENCE WITH TANKER DEBALLASTING MONITORING SYSTEMS
deVial, R. M., and R. V. Yates. 1976.
International Ship Operation Automation Symposium, 2nd,
Washington, D.C., 1976. New York, North Holland Publishing
Co., 1976. Vol. 5. p.425-431.

Monitoring, Oil discharges, Tankers, Pollution control, IMCO, Regulations, *Bailey Monitor Program

Growing concern by industry and government over the pollution of the marine environment by oil led to a succession of resolutions by the IMCO to restrict and control the location and long term effect of routine discharges from tankers. Significant events since 1954 are listed and discussed together with key events in the Bailey Monitor program.

[from MRIS Abstracts 14:#14 141333. 1976]

C-1331-77
OIL POLLUTION PREVENTION
Environmental Protection Agency. 1976.
Federal Register 41(60):12657-12658.

Pollution prevention, Oil discharges, Regulations, EPA, Contingency planning, Drilling, *Navigable waters

Amendments to the Environmental Protection Agency's regulations governing oil pollution prevention are reported. Facilities which might discharge oil in harmful quantities into navigable waters must prepare a Spill Prevention Control and Countermeasure (SPCC) plan, with special procedures for mobile or portable onshore or offshore drilling rigs. These regulations do not apply to vessels or transportation facilities subject to the control of the Department of Transportation.

[from Selected Water Resources Abstracts 10(9):#W77-04367. 1977]

C-1332-77
RESEARCH AND DEVELOPMENT ASSESSMENT ON SAFETY AND POLLUTION CONTROL FOR OUTER CONTINENTAL SHELF OPERATIONS
Funke, M. F., and B. A. Weber. 1976.
Final report, HDL-TR-1780. 52p.

Offshore drilling, Oil transport, Pollution prevention, Oil wells, Safety, OCS, Health hazards

An investigation has been made of the research, development, and data gathering that would provide some of the tools to be used to increase safety and decrease pollution hazards associated with offshore oil and gas exploration and production. Methods have been identified for reducing dangers (fire and explosion, asphyxiation, blowout, pollution, and unsafe rig conditions) to which workers and structures are exposed during drilling, production, and transportation operations.

[from Government Reports Announcements 77(7):#AD-A034 727/8GA. 1977]

C-1333-77
SPECIAL VEHICLES FOR SUPPORT OPERATIONS AND FIRE CONTROL WORK IN THE NORTH SEA
Haavie, T. 1976.
Offshore North Sea Technology Conference, Stavanger, Norway, 1976. Stavanger, Norway, NOROIL Publishing House, 1976. Safety and Environmental Protection Section, Paper S-111/6. 24p. Summary.

Offshore development, Pollution prevention, Oil spills, North Sea, *Support systems

Specialized materials and vehicles necessary in the support of various phases of offshore oil activity and accident prevention are outlined. The need for effective oil spill control and recovery systems is mentioned.

C-1334-77
ACOUSTIC METHOD FOR DETECTING LEAKS FROM SUBMERGED PIPELINES
Holland, W. E., and G. R. Burrell. 1977.
U.S. Patent 4,001,764

Leakage, Pipelines, Detection, Patent, *Acoustic leak detection

A sonar device directs acoustic waves along the path of a submerged pipeline, and the reflected waves are detected and recorded. The location of escaping liquid is then determined from the recorded reflected acoustic waves, the difference in these waves resulting from the difference in acoustic impedances between the escaping liquid and seawater.

[from Petroleum Abstracts 17(18):#233,070. 1977]

C-1335-77
ENVIRONMENTAL RESPONSIBILITY: INDUSTRY
Jagger, H. 1976.
Marine Ecology and Oil Pollution, J. M. Baker (ed.). New York, John Wiley & Sons, 1976. p.5-8. Institute of Petroleum/Field Studies Council Meeting, Aviemore, Scotland, 1975,

Oil industry, Environmental effects, Legislation, UK, Monitoring, Oil spills, Wastewaters

A responsible approach by the British oil industry and environmental legislation have successfully minimized environmental damage despite the industry's rapid growth. Monitoring of liquid effluents and oil spills has kept environmental damage to a minimum. Studies on the quality of oil industry products have also proved important.

C-1336-77

OIL SPILL COUNTERMEASURES FOR THE SOUTHERN BEAUFORT SEA
Logan, W. J., D. E. Thornton and S. L. Ross. 1975.
Canada Department of the Environment, Beaufort Sea Project technical report, No. 31a. 126p.

Spill cleanup, Oil wells, Pollution control, Disposal, Restoration, Beaches, Beaufort Sea

The feasibilities and limitation of controlling and cleaning up oil spillage in the Beaufort Sea resulting from an oil well blowout are analyzed. The Beaufort Sea environment is characterized and behavior of a blowout is considered. An assessment of presently available oil containment, removal and disposal techniques indicates that some countermeasures could be employed in waters with less than 10% ice concentration and in sea conditions up to Beaufort 3. No viable techniques are available for most ice conditions, and cleanup and restoration of contaminated shorelines are limited to sand and gravel beaches.

C-1337-77

OIL SPILL COUNTERMEASURES FOR THE BEAUFORT SEA: APPENDIX
Logan, W. J., D. E. Thornton, and S. L. Ross. 1976.
Canada Department of the Environment, Beaufort Sea Project technical report, No. 31b.

Spill cleanup. Pollution control, Detection, Monitoring, Disposal, Beaufort Sea, *Equipment evaluation

This reports presents technical data in support of information presented in the Beaufort Sea Project technical report 31a, a study of oil spill countermeasures applicable to the Beaufort Sea. Specifications and performance evaluations for oil detection, monitoring, containment, cleanup, recovery and disposal procedures and equipment are detailed and conceptual techniques are outlined.

C-1338-77
BASIC TRENDS AND TECHNICAL SOLUTIONS IN THE PREVENTION OF WATER AND ATMOSPHERIC POLLUTION BY REFINERIES AND PETROCHEMICAL WORKS [English summary]
Orlow, D. I. 1976.
Przemysl Chemiczny 55(9):454-458.

Refineries, Petrochemicals, Pollution prevention, Fuels, Wastewater treatment

"A review, without references, of 2 basic treands, i.e., the use of higher quality fuels and the improvement of the technology of waste purification."

[from Chemical Abstracts 86(12):#78141s. 1977]

C-1339-77
TWO CASE STUDIES OF THE PRACTICAL ENFORCEMENT OF POLLUTION STANDARDS IN HARBOURS: ROTTERDAM EUROPOORT
Peters, H. T. J. 1976.
Environmental Law: International and Comparative Aspects: A Symposium. J. Nowak (ed.). London, British Institute of International and Comparative Law, 1976. p.114-132.

Legislation, Pollution control, Law enforcement, Harbors, Tankers, Water quality, Netherlands

Dutch legislation governing water pollution is reviewed and international influences on water quality management are considered. Eighteen cleaning vessels of several hundred tons capacity each are available for cleaning tanks of tankers entering the harbors. Certain chemical slops and residues must be brought ashore for treatment. The quantity of slops could be reduced by structural modifications to the ships, improved cleaning techniques, and introduction of special tanks for certain bulk chemicals.

[from Oceanic Abstracts 14(1):#77-00980. 1977]

C-1340-77
ARCTIC MARINE OIL SPILL PROGRAM (AMOP)
Ross, S. L. 1977.
Spill Technology Newsletter 2(1):23-30.

Spill cleanup, Disposal, Behavior, Detection, Arctic, *Arctic Marine Oil Spill Program

The Canadian Government has recently approved and funded the Arctic Marine Oil Spill Program (AMOP), a five-year technology program to develop oil spill countermeasures for arctic waters. This article describes the AMOP management structure and outlines AMOP responsibilities and research and development objectives.

A tentative list of 20 planned AMOP projects includes studies on the effects and behavior of spilled oil and evaluation of oil spill detection, monitoring, cleanup and disposal methods and equipment.

C-1341-77
FREEWAY STORM RUNOFF WILL BE CLARIFIED
Rothstein, M. 1975.
Public Works 106(11):65.

Pollution prevention, Wastewater treatment, Michigan, *Freeway runoff

A 26 km section of Interstate 696 in Michigan is prepared to collect and treat all runoff before it enters Lake St. Clair. A 240 m settling and skimming chamber will prevent silt, debris, oil droppings and spills from entering and polluting the lake. Operation of the treatment chamber is detailed.

[from Environmental Health and Pollution Control 11(1):#145. 1977]

C-1342-77
ANTIPOLLUTION TECHNOLOGIES IN PETROLEUM REFINING AND PREPARATION [English summary]
Shibusawa, Y. 1975.
Nenryo-Kyokai-Shi 54(9):723-729.

Pollution prevention, Refining, Oil transport, Oil spills, Environmental effects, Oil industry

A review is given of the 9th World Petroleum Conference in which 20 papers on pollution prevention in oil refining, transport, and usage were presented. The articles were divided into four categories: (1) environmental protection in petroleum industries, (2) oil spills and their effects on marine environments, (3) desulfurization of oil and natural gas, and (4) exhaust emission controls.

[from Chemical Abstracts 86(20):#144781d. 1977]

C-1343-77
FIGHTING POLLUTION
Siemens, A. H. 1977.
Marine Policy 1(1):70-71.

Pollution prevention, Law enforcement, Spill cleanup, Surveillance, Source identification, USCG

The rapidly expanding areas of U.S. Coast Guard responsibility related to marine pollution prevention and environmental protection are discussed. A brief overview is presented of USCG programs for oil spill detection, surveillance, spill cleanup, identification, and regulation enforcement.

C-1344-77
OIL SPILL RESPONSE TRAILER (product information)
Slickbar, Inc. n.d.
Slickbar, Inc., Saugatuck Station, Westport, CT 06880

Spill cleanup, Pollution control, Booms, Skimmers

A mobile oil spill response trailer is described which contains and readily deploys equipment necessary for the control and cleanup of spills. Among the equipment are 300 m of spill containment booms, a 4.3 m work boat, a skimmer and pumping system, and a portable holding tank for 11,000 l of recovered oil.

C-1345-77
EQUIPMENT UPDATE
Solsberg, L. 1977.
Spill Technology Newsletter 2(1):8-10.

Pollution control, Spill recovery, Skimmers, Canada, *Equipment testing

The Environmental Emergency Branch of the Canada Environmental Protection Service is sponsoring a testing and evaluation program for spill control equipment. Included are evaluations of the following: a heater system for the Oil Mop Mark II-9D Skimmer which handles high viscosity oil products; the performance of twenty different sorbent products; the suitability of pumps for handling viscous fluids and "trash"; and the effectiveness of several commercially available oil skimmer systems under arctic conditions.

C-1346-77
TWO CASE STUDIES OF THE PRACTICAL ENFORCEMENT OF POLLUTION STANDARDS IN HARBOURS: MILFORD HAVEN
Sullivan, J. A. 1976.
Environmental Law: International and Comparative Aspects: A Symposium. J. Nowak (ed.). London, British Institute of International and Comparative Law, 1976. p.137-144.

Oil spills, Harbors, Pollution control, Ships, Law enforcement, UK, *Milford Haven

Statistical information on oil spills in Milford Haven, Britain's largest oil port, is reported. The legal difficulties in controlling polluting ships entering United Kingdom ports are discussed. The cooperation of five major international oil companies with pollution control in Milford Haven has minimized the necessity for legal measures.

[from Oceanic Abstracts 14(1):#77-00981. 1977]

C-1347-77
JANE'S OCEAN TECHNOLOGY
Trillo, R. L. (ed.). 1976.
New York, Franklin Watts, Inc., 1976. 680p.

Offshore development, Oil spills, Design and engineering, Regulations, Safety, Information systems, *Ocean technology

This information source outlines underwater, surface, and air systems equipment and techniques used in offshore operations. Topics covered include oil spills, subsea safety regulations and insurance factors, underwater processing operations, and others.

C. EFFECTS OF OIL POLLUTION

1. BIOLOGICAL EFFECTS

C-1348-77
LIGHT INTENSITY AND PRIMARY PRODUCTIVITY UNDER SEA ICE CONTAINING OIL
Adams, W. A. 1975.
Canada Department of the Environment, Beaufort Sea Project technical report, No. 29. 156p.

Ice, Phytoplankton, Algae, *Primary productivity, *Oil-under-ice, Beaufort Sea

Results are reported of an experimental field study and laboratory analysis of the effects of oil entrapped under ice upon algal primary productivity and light levels. Although light levels under the oiled ice were about 50% lower than in control areas, primary productivity, as measured by ^{14}C uptake, and diversity and abundance of phytoplankton species were all slightly higher than in control areas. Minor differences in salinity, temperature, and chemistry of the water under the oiled area were also noted. The effects of burning off the contaminant oil are reported; airborne particulates contaminated a wide area, speeded up surface melting of ice, and resulted in a dense growth of blue-green and macrophytic algae in surface pools.

C-1349-77
EFFECTS OF THE DELAWARE RIVER ESTUARY OF THE CORINTHOS OIL SPILL AT MARCUS HOOK ON JANUARY 31, 1975
Ahlert, R. C., W. Clement, H. H. Haskin, J. V. Hunter, and A. Sheier. 1975.
Staff report, NSF/RA/E-75/193; Grant NSF-G42282. 15p.

Oil spills, Estuaries, Delaware River, Toxicity, Fish, *Corinthos spill

Data collected subsequent to the Corinthos oil spill did not indicate any 96 hr fish toxicity in the adjacent waters either immediately or 60 hrs after the spill. Thus, whatever effects that existed seem mainly to be concentrated in the vicinity of the spill and disappeared rapidly thereafter.

[from Government Reports Announcements 77(9):#PB-262 734/7GA. 1977]

C-1350-77
A DESCRIPTION AND NUMERICAL ANALYSIS OF THE FACTORS AFFECTING THE PROCESSES OF PRODUCTION IN THE GULF OF ALASKA
Anderson, G. C., R. K. Lam, and B. Booth. 1976.
Environmental Assessment of the Alaskan Continental Shelf.
Principal Investigators' Reports for the Year Ending March 1976.
Vol. 6. p.35-58.

Biological effects, Offshore development, Oil spills, Primary production, Food web, Gulf of Alaska, Baseline studies

The primary production levels of the pelagic ecosystem in the Gulf of Alaska were investigated to determine the short term effects of oil spills and the long term effects of petroleum development on the food web. Results of this baseline study can be used to (1) compare conditions after petroleum development with the natural range of values in the pelagic ecosystem and (2) predict the types of modifications which may result due to a large scale oil spill.

[from Selected Water Resources Abstracts 10(4):#W77-01844. 1977]

C-1351-77
OIL BIOASSAYS WITH THE AMERICAN OYSTER, CRASSOSTREA VIRGINICA (GMELIN)
Anderson, R. D., and J. W. Anderson. 1976.
Report, NOAA-77010621; Grant NOAA-04-3-158-18. 8p. Proceedings of the National Shellfisheries Association. Vol. 65. p.38-42.

Dispersions, Crude oil, Fuel oil, Toxicity, Mollusks, *Oyster, *Crassostrea virginica

The oysters were exposed to oil-water dispersions of two crude and two partially refined petroleum hydrocarbons and a reference toxin. No. 2 fuel oil and Venezuela bunker C oil were found to be more toxic than the two crude oils tested, South Louisiana and Kuwait. Oysters demonstrated greater resistance to test oils than to the reference toxin, dodecyl sodium sulfate. Valve closure by oysters made it difficult to determine percent mortality data in 96 hr or extended time studies.

[from Government Reports Announcements 77(9):#PB-263 850/OGA. 1977]

C-1352-77
No title given (news brief)
Anon. 1977.
Chemical and Engineering News 55(11):20.

Natural seepage, Chronic effects, Marine organisms, Hydrocarbons, Santa Barbara Channel

A study of the sublethal effects of natural chronic exposure of marine organisms to oil seeps from the Santa Barbara

Channel revealed no evidence of malformations or change in total biomass. However, petroleum hydrocarbons were found in sea urchins, mussels, and in the viscera of abalone and lobster.

C-1353-77
DATA SHOWS CRUDE OIL LEAVES NO SIDE EFFECTS (news brief)
Anon. 1977.
Offshore 38(5):352.

Crude oil, Marine organisms, Biological effects, Platforms, Natural seepage, Chronic effects, API

A recent summarization of API-sponsored research concludes that crude oil from offshore platforms or natural seeps appears not to effect population levels and diversity of marine life and has negligible effects on growth or reproduction of marine organisms. The contaminated organisms seem to rapidly purge themselves once exposure has been terminated; and no abnormal growths or tumors are reported from organisms inhabiting areas under or near platforms or natural seeps.

C-1354-77
TOXIC REFLECTIONS ON AN OIL SPILL (news brief)
Anon. 1977.
Science News 111(20):311.

Oil spills, Fuel oil, Toxicity, Microorganisms, Yeasts, *Ultraviolet light exposure

Fuel oil experimentally exposed to summertime levels of ultraviolet light was found to produce highly toxic peroxides and acidic compounds by photooxidation. Toxicity to microorganisms such as yeasts reached a maximum within 24 hours. If applied during the first 24 hours of the oil's exposure to light, a mildly reducing agent called thiacyclohexane was found to markedly suppress the toxicity of the spill.

C-1355-77
WORLD WAR II EAST COAST OIL SPILLS DID LITTLE HARM
Anon. 1977.
Sea Technology 18(4):45-46.

Oil spills, Environmental effects, Shorelines, Atlantic coast, *World War II spills

During World War II, especially between January and June of 1942, 20 times as much oil was spilled from tankers sunk by German submarines as from the "Argo Merchant" which split apart in December, 1976, off Cape Cod. Conclusions drawn by researchers at the Massachusetts Institute of Technology who analyzed the spills and evaluated historical and present-day effects on shoreline ecology revealed that these spills caused no apparent long term damage.

C-1356-77

RESPONSES OF THE LICHENS *PELTIGERA APHTHOSA* AND *CETRARIA NIVALIS* AND THE ALGA *NOSTOC COMMUNE* TO SULFUR DIOXIDE, NATURAL GAS, AND CRUDE OIL IN ARCTIC ALASKA

Atlas, R. M., and E. Schofield. 1975.
Astarte 8(2):53-60.

Plants, *Lichens, Algae, Biological effects, Crude oil, Arctic, Alaska

The sensitivity of Arctic populations of the title organisms to natural gas, sulfur dioxide and crude oil was determined by measuring rates of N fixation, CO_2 fixation, and O_2 consumption. Prudhoe crude oil severely inhibited both N_2 and CO_2 fixation. Lichens appeared to be less sensitive to the pollutants than the free alga.

[from Biological Abstracts 63(3):#14221. 1977]

C-1357-77

ECOLOGICAL CHANGES IN MILFORD HAVEN DURING ITS HISTORY AS AN OIL PORT

Baker, J. M. 1976.
Marine Ecology and Oil Pollution. J. M. Baker (ed.). New York, John Wiley & Sons, 1976. p.55-66. Institute of Petroleum/Field Studies Council Meeting, Aviemore, Scotland, 1975.

Ports, Oil spills, Wastewaters, Refineries, Environmental effects, Marine organisms, UK, *Milford Haven

The current ecological state of Milford Haven after 15 years of industrialization is described. There are still no overall changes which can be attributed to the oil industry. Oil spills have caused short term localized effects, the most severe of such effects occurring over about one mile of shore as a result of the "Dona Marika" oil spill of 1973. Localized chronic effects in Little Wick Bay are associated with a refinery effluent, and the death of a patch of *Spartina* marsh at Martinshaven may also have resulted from chronic pollution. Unidentified slicks outside the mouth of the Haven have been a cause for concern.

C-1358-77

THE FIELD STUDIES COUNCIL OIL POLLUTION RESEARCH UNIT

Baker, J. M. 1976.
Marine Ecology and Oil Pollution. J. M. Baker (ed.). New York, John Wiley & Sons, 1976. p.17-19. Institue of Petroleum/Field Studies Council Meeting, Aviemore, Scotland, 1975.

Oil spills, Monitoring, Wastewaters, Refineries, Biological effects, Ports, UK, *Milford Haven, *Oil Pollution Research Unit

A brief review is presented of the background and the current status and involvement of the Field Studies Council Oil Pollution Research

Unit in restoring the polluted Milford Haven port to an ecological balance. The effects of oil and dispersants on the behavior of marine species are described and the monitoring of toxic substances along the port's rocky shores and salt marshes is discussed.

C-1359-77
INVESTIGATION OF REFINERY EFFLUENT EFFECTS THROUGH FIELD SURVEYS
Baker, J. M. 1976.
Marine Ecology and Oil Pollution. J. M. Baker (ed.). New York, John Wiley & Sons, 1976. Institute of Petroleum/Field Studies Council Meeting, Aviemore, Scotland, 1975.

Wastewaters, Refineries, Biological effects, Marshes, Shorelines, Vegetation, UK

Field surveys were carried out to find the species and areas affected by refinery effluent discharges. It is possible to classify effluents according to their ecological effects, and the effluentdispersal characteristics form the best basis for such a classification. Well dispersed offshore discharges from modern refineries may not cause any measurable biological changes; however, poorly dispersed discharges (in mudflat or salt marsh areas) may greatly reduce species near the effluent. Both salt and freshwater marsh vegetation are capable of surviving at least some chronic oil pollution. The deliberate management of such communities as a final stage in effluent treatment is mentioned.

C-1360-77
AN OIL SPILL IN THE STRAITS OF MAGELLAN
Baker, J. M., et al. 1976.
Marine Ecology and Oil Pollution. J. M. Baker (ed.). New York, John Wiley & Sons, 1976. p.441-472. International Petroleum/ Field Studies Council Meeting, Aviemore, Scotland, 1975.

Metula spill, Biological effects, Birds, Mollusks, Algae, Fisheries, Strait of Magellan

The short and long term effects of the "Metula" oil spill are described. An estimated 3000 to 4000 cormorants and penguins were killed and some mussel beds and algae were contaminated, but no reports were received of damage to commercial fisheries.

C-1361-77
RESPONSE OF SOME BLACK SEA HYDROBIONTS IN AN ELECTRICAL CURRENT FIELD DURING POISONING WITH DISSOLVED PETROLEUM PRODUCTS [in Russian]
Balaev, L. A., N. D. Mazmanidi, and T. R. Bazhashvili. 1976.
Voprosy Ikhtiologii 16(4):715-720.

Petroleum products, Toxicity, Marine organisms, Fish, Benthos, Black Sea, *Shrimp, *Electrical currents

Increased sensitivity to electrical currents was the property used to measure the toxicity of dissolved petroleum products to six species of Black Sea organisms. Pelagic fish were sensitive to lower concentrations of petroleum products than benthic species. Shrimp were more resistant to the petroleum pollutants than any of the fish species.

[from Chemical Abstracts 86(15):#101548v. 1977]

C-1362-77
POSSIBILITY OF THE TISSUE ACCUMULATION AND ELIMINATION OF 3,4-BENZOPYRENE FROM FISH [English summary]
Baranova, L. N., P. P. Dikun, I. N. Ostroumova, and L. A. Timoshina. 1976.
Voprosy Onkologii 22(11):102-105.

Petroleum products, PAH, Uptake, Release, Fish, *3,4-benzopyrene

In this study, 3,4-benzopyrene was not found to accumulate in the tissues of carp and rainbow trout exposed to diets containing this substance for one year. Relative amounts of dietary 3,4-benzopyrene excreted in unchanged form were higher in winter than in summer.

[from Chemical Abstracts 86(11):#66583z. 1977]

C-1363-77
SURVEY OF MARINE COMMUNITIES IN PANAMA AND EXPERIMENTS WITH OIL
Birkeland, C., A. A. Reimer, and J. R. Young. 1976.
Report EPA-600/3-76-028, Contract No. 14-12-874. 176p.

Fuel oil, Marine organisms, Biological effects, Tropical regions, Intertidal zone, Corals

Effects of oil pollution on tropical intertidal marine communities were tested by controlled experiments using tarry Bunker C and volatile marine diesel oils. Bunker C had a greater detrimental effect than did marine diesel on coral growth. Marine diesel had a greater detrimental effect on fouling communities of settling plates. Susceptibility to oil pollution varied significantly between individuals.

C-1364-77
AN OIL SPILL IN AN ALPINE HABITAT
Blesky, J. 1975.
Northwest Science 49(3):141-146.

Oil spills, Environmental deterioration, Vegetation, Washington, *Alpine meadow

A study was made of the damage to vegetation caused by a spill of 26,500 l (7,000 gal) of diesel fuel into an alpine meadow near Mt. Baker, Washington. Most herbaceous plants in the Carex nigricans and Phyllodoce empetriformis - Cassiope mertensiana associations were killed; woody species were severely damaged but survived the effects of the oil. Root systems of the plants escaped major damage. One year later C. nigricans and C. lenticularis and various mosses were invading the area.

[from Ecological Abstracts 1976(4):#76 L/2813. 1976]

C-1365-77
A FOUR-YEAR ANALYSIS OF VEGETATION FOLLOWING AN OIL SPILL IN A FRESH WATER MARSH
Burk, C. J. 1976.
Report No. Completion-FY-76-15, Pub-71, W77-00147; OWRT-A-042-MASS (2). 46p. PB-258, 766/5GA.

Oil spills, Biological effects, Plants, Sampling, Marshes, *Species reduction

Total plant cover and diversity measured by species richness, mean species per quadrant, and the Shannon-Wiener function were progressively reduced in both high and mid-marsh zones for two years after the spill. Eighteen of the species found before the spill were not found the season following. Perennial species tended to be less affected by the oil immediately following the spillage than annual species.

[from Petroleum Abstracts 17(19):#233,281. 1977]

C-1366-77
EFFECT OF THE WATER SOLUBLE FRACTION OF CRUDE, REFINED AND WASTE OILS ON THE EMBRYONIC AND LARVAL STAGES OF THE QUAHOG CLAM, MERCENARIA SP.
Byrne, C. J. and J. A. Calder. 1977.
Marine Biology 40(3):225-231.

Toxicity, Mollusks, Crude oil, Fuel oil, Waste oil, *Clams, *Mercenaria sp.

The effects of crude and fuel oils on the survival and growth rates of the quahog clam, Mercenaria sp., were investigated. Kuwait crude was the least toxic oil and waste crankcase oil was the most toxic, while Bunker C and No. 2 fuel oil had intermediate values. Surviving larvae exposed to the various oils grew at slower rates than controls.

C-1367-77

EFFECT OF DISSOLVED AROMATIC HYDROCARBONS ON THE GROWTH OF MARINE BACTERIA IN BATCH CULTURE
Calder, J. A., and J. H. Lader. 1976.
Report NSF/IDOE-76-184; Grant NSF-ID073-09745. 8p.

Bacteria, Aromatic hydrocarbons, Toxicity, Biological effects

The growth rate and maximum cell density of marine bacteria in batch cultures were found to decrease with increasing concentrations of dissolved aromatic hydrocarbons. Toxicity levels were observed to increase inversely with solubility, and partial oxidation of naphthalene caused complete cessation of growth at high concentrations.

[from Government Reports Announcements 77(6):#PB-261 893/2G. 1977]

C-1368-77

ACUTE AND CHRONIC TOXICITY OF SEAWATER EXTRACTS OF ALASKAN CRUDE OIL TO ZOEAE OF THE DUNGENESS CRAB, CANCER MAGISTER DANA
Caldwell, R. S. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 8. p.345-375.

Crude oil, Toxicity, Crustaceans, Acute effects, Chronic effects, Alaska, *Cancer magister Dana, *Water soluble fraction

The seawater soluble fraction of Cook Inlet crude oil was found to be acutely toxic to first instar C. magister larvae, but no toxic effects were noted for a 1/10 dilution of this fraction during long-term exposures. Under similar conditions naphthalene had no toxic effects; benzene resulted in reduced larval survival suggesting that benzene may account for a major portion of the toxicity of the fraction.

[from Selected Water Resources Abstracts 10(4):#W77-01873. 1977]

C-1369-77

EFFECTS OF IRANIAN CRUDE OIL ON THE RED SEA OCTOCORAL HETEROXENIA FUSCESCENS
Cohen, Y., A. Nissenbaum, and R. Eisler. 1977.
Environmental Pollution 12(3):173-186.

Crude oil, Toxicity, Acute effects, Corals, Red Sea, *Heteroxenia fuscescens

Acute toxicity and sublethal effects of Iranian crude oil on colonies of the Red Sea octocoral Heteroxenia fuscescens were studied under static and continuous flow assay conditions. Static bioassays showed the crude oil concentration of 12 ml/l to be 50% fatal, whereas continuous flow bioassays showed no deaths at concentrations of 10 ml/l. Gas chromatographic analysis of the hydrocarbon composition of exposed *Heteroxenia* indicated that petroleum derived hydrocarbons were incorporated into tissues and this exposure to high sublethal oil levels could result in long term deleterious effects.

C-1370-77
THE PHYSIOLOGICAL EFFECT OF ACUTE AND CHRONIC EXPOSURE TO HYDROCARBONS OF PETROLEUM ON THE NEAR-SHORE FISHES OF THE BERING SEA
DeVries, A. L. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 8. p.1-14.

Hydrocarbons, Toxicity, Fish, Acute effects, Chronic effects, Bering Sea, Alaska

Toxicity data for water soluble hydrocarbons on Bering Sea fishes are given. The effects of temperature and oxygen consumption on hydrocarbon toxicity to fishes are presented.

[from Selected Water Resources Abstracts 10(4):#W77-01864. 1977]

C-1371-77
THE EFFECTS OF REFINERY EFFLUENTS: THE CASE HISTORY OF A SALTMARSH
Dicks, B. 1976.
Marine Ecology and Oil Pollution. J. M. Baker (ed.). New York, John Wiley & Sons, 1976. p.227-245. Institue of Petroleum/Field Studies Council Meeting, Aviemore, Scotland, 1975.

Wastewaters, Refineries, Biological effects, Vegetation, Marshes, UK, *Saltmarsh

A *Spartina* saltmarsh in Southampton Water, which has had a refinery effluent discharged through its creek since 1951, was surveyed biologically in 1969 and 1970 to assess the extent of ecological damage. The saltmarsh has been resurveyed twice a year since 1972 to monitor any changes in the distribution of plant species in association with an effluent improvement program started by the refinery. Survey results are presented and discussed.

C-1372-77
THE IMPORTANCE OF BEHAVIOURAL PATTERNS IN TOXICITY TESTING AND ECOLOGICAL PREDICTION
Dicks, B. 1976.
Marine Ecology and Oil Pollution. J. M. Baker (ed.). New York, John Wiley & Sons, 1976. p.303-319. Institute of Petroleum/Field Studies Council Meeting, Aviemore, Scotland, 1975.

Toxicity, Contaminants, Marine organisms, Behavior, *Sublethal effects

Toxicity tests for oil pollutants which rely on mortality of a test organism do not take into account that changes in behavior in response to sub-lethal doses of pollutant may have far-reaching ecological effects, and that natural rhythm in an animal's activity may substantially influence its susceptibility to pollutants. Examples are given which illustrate these points.

C-1373-77
ACUTE HYDROCARBON INTOXICATION IN A COMMON SEAL PHOCA VITULINA [in French]
Duguy, R., and P. Babin. 1976.
Annales de la Societe des Sciences Naturelles de la Charente-Maritime 6(3):194-196.

Marine mammals, Toxicity, Hydrocarbons, Acute effects, *Seals, *Phoca Vitulina

Summary not available.

[from Bioresearch Index 13(2):#9854. 1977]

C-1374-77
BIOLOGICAL EFFECTS OF WATER-SOLUBLE FRACTIONS OF OILS
Environmental Protection Agency. 1974.
July 1 - December 1974 semi-annual report, Environmental Protection Agency, Narragansett, Rhode Island Laboratory. p.120-123.

Hydrocarbons, Biological effects, *Water soluble fractions

Summary not available.

[from On Effects of Oil Pollution in Arctic and Subarctic Waters. Northwest Marine Fisheries Center, September, 1976]

C-1375-77

SUMMARY TABULATION OF SELECTED EPA ACTIVITIES CONCERNING TOXIC CHEMICALS
Environmental Protection Agency. 1976.
Report PB-253172. 19p.

Contaminants, Fuel oil, Hydrocarbons, Toxicity, *Fuel additives

"The toxicities of air and water pollutants, including pesticides, fuel oil, hydrocarbons and fuel additives are tabulated."

[from Chemical Abstracts 86(12):#78069z. 1977]

C-1376-77

THE ARCTIC COASTAL ENVIRONMENT OF ALASKA. VOL. II: A COMPILATION AND REVIEW OF SCIENTIFIC LITERATURE OF THE ARCTIC MARINE ENVIRONMENT
Feder, H. M., D. G. Shaw, and A. S. Naidu. 1976.
Sea Grant Report No. 76-9, SG-04-5-158-35. 207p.

Oil spills, Environmental effects, Marine organisms, Arctic, Alaska, *Prudhoe Bay

"This reference, for the convenience of the user, is divided into eleven chapters as follows: Physical Oceanography; Chemical and Geological Oceanography; Plankton; Benthic Algae; General Ecological and Biological Studies; Ice Algae; Benthic Microalgae and Primary Production; Benthic Invertebrates; Fishes; Marine Birds and Mammals; Environmental Impact; and Oil Pollution: Environmental Effects of an Oil Spill at Prudhoe Bay."

[from Selected Water Resources Abstracts 10(6):#W77-02665. 1977]

C-1377-77

FATE OF LABELED N-ALKANES IN THE BLUE CRAB AND STRIPPED [sic] MULLET
Geiszler, P. C., B. J. Grantham, and G. J. Blomquist. 1977.
Bulletin of Environmental Contamination and Toxicology 17(4):463-467.

Hydrocarbons, Uptake, Release, Metabolism, Fish, Crustaceans, *Labeled n-alkanes

A laboratory study was conducted on the differences in uptake, release and metabolism of long-chain n-alkanes in the blue crab, *Callinectes sapidus*, and the striped mullet, *Mugil cephalus*. The blue crab rapidly took up and within 14 days discharged most of the labeled n-alkanes without metabolizing them. The mullet readily metabolized ingested n-alkanes, probably via microorganisms in the gut. The n-alkanes absorbed via the gills were metabolized to a lesser degree.

C-1378-77
PHYSIOLOGICAL IMPACT OF OIL ON PINNIPEDS
Gentry, R., and W. B. McAlister. 1976.
Environmental Assessment of the Alaskan Continental Shelf.
Principal Investigators' Reports for the Year Ending March 1976.
Vol. 8. p. 15-23

Oil spills, Biological effects, Marine mammals, Metabolism, Alaska, *Physiology, *Pinnipeds

Field and laboratory physiological measurements were taken of pinnipeds and otters encountering an oil spill. Oil fouling of the fur was found to impair its insulative properties, leading to an altered metabolic rate and decreased diving performance.

[from Selected Water Resources Abstracts 10(4):#W77-01865. 1977]

C-1379-77
THE INVESTIGATIONS OF THE OIL POLLUTION ON THE POLISH COAST OF THE BALTIC SEA IN 1970-1974 [English Summary]
Gorski, W., B. Jakuczun, C. Nitecki, and A. Petryna. 1976.
Przeglad Zoologiczny 20(1):81-87.

Birds, Contamination, Statistics, Baltic Sea, *Mortality

Investigations of the effect of oil pollution on seabirds in the Baltic Sea were conducted from 1970-1974 and 3900 dead birds were recorded as having died form oiled feathers or oil ingestion. The highest mortality was recorded during the winter months and the highest fatalities were among the scooters, longtailed ducks, auks, and gulls.

[from Aquatic Sciences and Fisheries Abstracts 7(2):#7Q1902. 1977]

C-1380-77
EFFECTS OF CRUDE OIL ON CORALS
Grant, E. M. 1975.
International Ocean Development Conference, 3rd, Tokyo, 1975.
Vol. 4, Marine Pollution. p. 154-190. [Available from Secretary of International Ocean Development Conference, Japan Management Association, Tokyo, Japan.]

Crude oil, Corals, Biological effects, *Growth, *Great Barrier Reef

On an emergent coral reef of the Great Barrier Reef, living corals were experimentally oiled for several hours. Their subsequent survival and growth were monitored for 4.5 months, and both the corals and associated fauna appeared to survive unharmed.

[from The Engineering Index Monthly 15(4):#028815. 1977]

C-1381-77
ALTERED YOLK STRUCTURE AND REDUCED HATCHABILITY OF EGGS FROM BIRDS FED SINGLE DOSES OF PETROLEUM OILS
Grau, C. R., T. Roudybush, J. Dobbs, and J. Wathen. 1977.
Science 195(4280):779-781.

Fuel oil, Biological effects, Birds, *Yolk structure, *Egg hatchability

Single doses containing 200 mg of bunker C oil were fed to Japanese quail and were found to result in abnormal structure and staining properties of deposited yolk for 24 hours after ingestion. Fewer eggs were laid for 4 days after dosing and hatchability was drastically reduced. Three other reference oils were tested on quail, Canada geese, and chickens and were found to affect yolk structure.

C-1382-77
TOXIC EFFECTS OF WATER-SOLUBLE FRACTIONS OF CRUDE, REFINED, AND WEATHERED OILS ON THE GROWTH OF A MARINE BACTERIUM
Griffin, L. F., and J. A. Calder. 1977.
Applied and Environmental Microbiology 33(5):1092-1140.

Crude oil, *Refined oil, Toxicity, Metabolism, Bacteria, Marine organisms, Weathering

Water soluble fractions of three crude and two refined oils inhibited the growth rate and maximum cell density of the marine bacterium, *Serratia marinorubra*, grown in batch culture. Simulated weathering of a crude and refined oil in the laboratory formed water soluble fractions that were significantly more toxic than the parent unweathered oils.

C-1383-77
INTRA- AND INTERSPECIFIC VARIABILITY IN TOLERANCE OF SOUTHERN CALIFORNIA *LITTORINA PLANAXIS* AND *LITTORINA SCUTULATA* TO PETROLEUM
Hadley, D. 1977.
Environmental Research 13(2):186-208.

Petroleum products, Biological effects, Mollusks, Southern California, *Tolerance variability, **Littorina*

Variations were observed in tolerance of *Littorina* to different petroleum at 6, 17 and 29°C, as indicated by mortality rate and rate of animal attachment to substrate. While *L. scutulata* exhibited a greater tolerance to various conditions at 6°C, *L. planaxis* had a greater tolerance at 29°C. Gasoline had the greatest influence on attachment rates at all temperatures, and kerosene had the least effect. There was no consistent attachment rate trend among crude oils; however, their influence was intermediate between that of gasoline and kerosene.

C-1384-77
THE IMPACT OF ENVIRONMENTAL POLLUTANTS ON WILDLIFE- AN OVERVIEW
Hartung, R. 1976.
Wildlife Diseases. L. A. Page (ed.). New York, Plenum Press, 1976. p.317-332.

Crude oil, Contamination, Birds, Wildlife, Acute effects, Chronic effects

A brief review is presented of the effects on wildlife of environmental contamination by mercury, lead, chlorinated hydrocarbons, and oil. The section on oil pollution deals primarily with acute and long term effects of spills and chronic contamination on waterfowl.

C-1385-77
EFFECTS OF FOUR OILS ON MARINE BACTERIAL POPULATIONS: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT
Hodson, R. E., F. Azam, and R. F. Lee. 1977.
Bulletin of Marine Science 27(1):119-126.

Toxicity, Crude oil, Fuel oil, Bacteria, Coasts, Canada, *Glucose uptake

The effects of Louisiana and Kuwait crudes, No. 2, and Bunker C fuel oils on heterotrophic uptake and mineralization of D-glucose by microbial populations from Saanich Inlet, Canada, were examined. All oils inhibited uptake and mineralization, with the two processed oils being more toxic than the crude oils. Populations did not acquire tolerance to oil after one month's exposure.

[from Petroleum Abstracts 17(15):#232,315. 1977]

C-1386-77
SCIENTISTS FIND NO ILL EFFECTS FROM TORPEDOED WWII OIL TANKERS - ARGO MERCHANT'S 6 MILLION GALLONS ONLY A FRACTION OF 1942 SPILLS
Hurd, S. B. 1977.
Sea Grant '70s 7(8):4-5.

Oil spills, *1942 WWII spills, Tankers, Atlantic coast, Environmental effects, Movement

About 530 million liters (145 million gallons) of oil were spilled along the U.S. East Coast in 1942 as tankers were sunk by German submarines. Recent research by Massachusetts Institute of Technology scientists, using historical records of 1942 spills and their effects and computer simulation of spill movement trajectories, indicates that few if any long-term adverse effects on the coastal environments resulted from the spills.

C-1387-77

OUTER CONTINENTAL SHELF ASSESSMENT PROJECT. RAZOR CLAM HABITAT SURVEY - GULF OF ALASKA

Kaiser, R. J., and D. Konigsberg. 1976.
Environmental Assessment of the Alaskan Continental Shelf.
Principal Investigators' Reports for the Year Ending March 1976.
Vol. 6. p.17-31.

Oil spills, Biological effects, OCS, Mollusks, Habitat, Offshore development, Gulf of Alaska, *Clams, Baseline studies

The extent of the Pacific razor clam populations in the Gulf of Alaska between Unimak Bight and the 139 degree West longitude is defined,and the importance of this clam in terms of recreational and commercial utilization is reported. Since most of the important razor clam beaches are near areas of current or proposed oil development, the habitat of this species on the open beaches makes it vulnerable to possible oil spills.

[from Selected Water Resources Abstracts 10(4):#W77-01843. 1977]

C-1388-77

EFFECTS OF CRUDE OIL INGREDIENTS ON THE DEVELOPMENT AND OXYGEN UPTAKE OF HARD CLAM MERETRIX LUSORIA (RODING) [English summary]

Lee, B. D., T. Y. Lee, and P. Chin. 1975.
Pusan Susan Taehak Haeyang Kwahak Yonguso Yongu Pogo 8:31-38.

Crude oil, Mollusks, Biological effects, *Larvae, *Oxygen uptake, *Meretrix lusoria

The effects of crude oil components on the cleavage, larval development and oxygen consumption of the title organism were determined. Abnormalities produced by using 3 and 10 ppm of hexane-extractable organics were 47.1% and 43.1%, respectively, of the control value. Oxygen consumption was decreased 25.9% by the presence of 5 ppm hexane extractable organics, 29.1% in a medium containing 10 ppm phenols, and 42.8% in a medium containing 0.5 ppm sulfides.

[from Chemical Abstracts 86(13):#84370g. 1977]

C-1389-77

EFFECTS OF ENVIRONMENTAL STRESS ON THE COMMUNITY STRUCTURE AND PRODUCTIVITY OF SALT MARSH EPIPHYTIC COMMUNITIES. PROGESS REPORT, SEPTEMBER 1, 1975 -AUGUST 31, 1976

Lee, J. J. 1976.
ERDA report, COO-3254-32; Contract E(11-1) 3254. 200p.

Crude oil, Phytoplankton, Marshes, Biological effects, *Environmental stress, *Diatoms

The studies conducted on environmental stress included an in situ incubation subproject aimed at testing the effects of water quality, heavy metals, and crude oil on natural assemblages of diatoms. Observed changes in the diatom assemblages enriched by various pollutants are compared.

[from ERDA Energy Research Abstracts 2(1):#3859. 1977]

C-1390-77
THE EFFECTS OF THE WATER SOLUBLE FRACTIONS OF NO. 2 FUEL OIL ON THE SURVIVAL AND BEHAVIOR OF COASTAL AND OCEANIC ZOOPLANKTON
Lee, W. Y., and J. A. C. Nicol. 1977.
Environmental Pollution 12(4):279-292.

Toxicity, Fuel oil, Acute effects, Behavior, Zooplankton, *Water soluble fractions

Acute effects of water-soluble fractions of No. 2 fuel oil on both coastal and oceanic zooplankton were studied and their LC_{50} for various exposure times (1 to 72 hr) were compared. Coastal zooplankton seemed to be more resistant than oceanic zooplankton, probably due to the dissimilar species composition of the two populations.

C-1391-77
SURVIVAL OF TWO SPECIES OF AMPHIPODS IN AQUEOUS EXTRACTS OF PETROLEUM OILS
Lee, W. Y., M. F. Welch, and J. A. C. Nicol. 1977.
Marine Pollution Bulletin 8(4):92-94.

Toxicity, Crude oil, Fuel oil, Crustaceans, *Amphipods

No. 2 fuel oil and Southern Louisiana crude were toxic at concentrations of 0.8 ppm and 2.4 ppm, respectively. Mortalities increased with the concentration and length of exposure. Few or no young were produced at these and higher concentrations. The amphipods are more sensitive to aqueous extracts of these oils than benthic polychaetes and shrimp for which data are available.

C-1392-77
EFFECTS OF REFINERY WASTES ON LITTORAL ECOLOGY [English summary]
Le Petit, J., M. -H. N'Guyen, and S. Tagger. 1977.
Environmental Pollution 13(1):41-56.

Refineries, Wastewaters, Biodegradation, Environmental effects, Marine organisms, Bacteria, Phytoplankton, France

The effects of effluent from a petroleum refinery in southern France on the ocean environment, phytoplankton production, and bacterial populations were studied. Bacteria utilizing gas-oil as the sole source of carbon were found to comprise 10% of the heterotrophic bacteria in the effluent area and 4% in an uncontaminated control area. Physical and chemical conditions in the effluent area are favorable for hydrocarbon degradation by bacteria.

C-1393-77
THE EFFECT OF KUWAIT CRUDE OIL AND THE DISPERSANT BP1100X ON THE LUGWORM, *ARENICOLA MARINA* L.
Levell, D. 1976.
Marine Ecology and Oil Pollution. J. M. Baker (ed.). New York, John Wiley & Sons, 1976. p.131-185. Institute of Petroleum/ Field Studies Council Meeting, Aviemore, Scotland, 1975.

Crude oil, Dispersants, Biological effects, Polychaetes, UK, **Arenicola marina* L, *Milford Haven

This paper describes field experiments on *A. marina* L. carried out at a small estuary in Milford Haven. A single spillage of pollutants caused a 25-50% reduction in population density; four successive spillages resulted in eradication of the original *Arenicola* population of 20-25/0.25 m^2. The influence of surface water and heavy rainfall on the extent of the pollutant effect was also determined. In studies to measure the effect of pollution by Kuwait crude oil on the feeding behavior, it was found that between 50 and 75% of the original population recovered normal feeding activity.

C-1394-77
CHANGES IN THE FLORA OF SOIL FUNGI FOLLOWING OIL WASTE APPLICATION
Llanos C., and A. Kjoller. 1976.
Oikos 27(3):377-382.

Crude oil, Waste oil, Soil, Biological effects, Fungi, Biodegradation

The application of oil to soil resulted in an increase in the number of colony-forming units and in the length of mycelium of soil fungi of several genera. The treatment favored the growth of *Graphium* and *Paecilomyces* which were almost absent in control areas. Biodegradation of crude oil and pure hydrocarbons by these dominating fungi was demonstrated in culture.

[from Biological Abstracts 63(6):#35838. 1977]

C-1395-77
SUBLETHAL EFFECTS AS REFLECTED BY MORPHOLOGICAL, CHEMICAL, PHYSIOLOGICAL AND BEHAVIORAL INDICES
Malins, D. C., H. O. Hodgins, and D. D. Weber. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 8. p.119-138.

Crude oil, Toxicity, Fish, Alaska, *Liver and skin tissues

The effects of crude oil on the cell biology of liver and skin tissues of trout, salmon, and sole are reported. The depletion of glycogen and lipid in the liver and of mucus at the skin surface of all three fish is considered to be due to the effects of oil. However, feeding high levels of crude oil to sexually maturing trout for six months did not result in mortality, damage to spawning, or impaired viability of eggs and sperm.

[from Selected Water Resources Abstracts 10(4):#W77-01869. 1977]

C-1396-77

IDENTIFICATION OF MAJOR PROCESSES IN BIOTRANSFORMATIONS OF PETROLEUM HYDROCARBONS AND TRACE METALS
Malins, D. C., W. L. Reichert, and W. T. Roubal. 1976.
Environmental Assessment of the Alaskan Continental Shelf.
Principal Investigators' Reports for the Year Ending March 1976.
Vol. 8. p.139-153.

Hydrocarbons, Biological effects, Fish, Crustaceans, Alaska, Uptake, Release, *Biotransformation

The physiological and biological effects of hydrocarbons on salmon, flatfish, and spotted shrimp are evaluated and identified, and uptake and depuration studies of hydrocarbons are reported. Trace metal effects on salmon and flatfish are also presented. Emphasis is placed on the establishment and standardization of experimental techniques.

[from Selected Water Resources Abstracts 10(4):#W77-01870. 1977]

C-1397-77

THE EFFECT OF DISSOLVED PETROLEUM PRODUCTS ON SOME OF THE ASPECTS OF CARBOHYDRATE METABOLISM IN FISHES AND INVERTEBRATES
Masmanidi, N. D., and G. I. Kovaleva. 1975.
Journal of Ichthyology 15(5):811-816.

Toxicity, Petroleum products, Metabolism, Fish, Invertebrates

It is concluded from the similarity of the reaction of fish, mussels and shrimps to the effects of acute, subacute and chronic toxicity to petroleum that there may be a single mechanism in the action of dissolved petroleum products on living structures.

[from Selected Water Resources Abstracts 10(8):#W77-04030. 1977]

C-1398-77

ACUTE TOXIC EFFECTS OF PETROLEUM REFINERY WASTEWATERS ON REDEAR SUNFISH

Matthews, J. E., and L. H. Myers. 1976.
EPA/600/2-74-241. 62p.

Toxicity, Wastewaters, Refineries, Freshwater, Fish, Acute effects, *Redear sunfish

Static bioassays of 24 hours' duration were performed using samples of wastewaters provided by 22 domestic oil refineries and redear sunfish as test organisms. Twenty-four hour 50 percent tolerance limits of the wastewaters are compared with results of chemical analyses performed during the same study. Toxicity varied considerably between refineries and for waste streams within a single refinery. Results of analyses and observed behavioral symptoms of distressed fish revealed that ammonia, sulfides, and phenolics were major contributors to toxicity in most samples.

[from Government Reports Announcements 77(8):#PB-262 913/7GA. 1977]

C-1399-77

ACUTE TOXICITY OF SELECTED ORGANIC COMPOUNDS TO FATHEAD MINNOWS

Mattson, V. R., J. W. Arthur, and C. T. Walbridge. 1976.
Report EPA-600/3-76-097. 13p.

Hydrocarbons, Toxicity, Acute effects, Fish, *Fathead minnows

Juvenile fathead minnows were exposed to five classes of organic compounds: acids, alcohols, hydrocarbons, ketones and aldehydes, and phenols. Alcohols were generally 10-100-fold less toxic than the four other classes of compounds which had similar toxicity ranges. Hydrocarbons were intermediate in toxicity between pentachlorophenol, the most lethal chemical, and ethanol, the least toxic.

[from Chemical Abstracts 86(17):#115743n. 1977]

C-1400-77

FIELD STUDIES SHOW OIL PRODUCTION AND ENVIRONMENT REMAIN COMPATIBLE

Mertens, E. W. 1977.
Oil and Gas Journal 75(10):124,126

Crude oil, Marine organisms, Biological effects, Platforms, Natural seepage, API, Chronic effects

A brief synopsis is given of several field studies examining the effects of chronic low-level exposure of marine life to oil spills. These studies, sponsored by the American Petroleum Institute, indicate that "low-level chronic exposure to oil has, at most, negligible effects on marine life"; and that platforms provide a structure that supports a thriving, highly complex community of marine life.

C-1401-77
PETROLEUM POLLUTION [in Russian]
Mironov, O. G. 1976.
Itogi Nauki Tekhniki, Obshchaya Ekologiya, Biotsenologiya, Gidrobiologiya 3:81-109.

Petroleum products, Crude oil, Contamination, Biological effects

"A review with 68 references on water pollution by petroleum and its biological effects."

[from Chemical Abstracts 86(13):#84261x. 1977]

C-1402-77
OIL POLLUTION AND ORIELTON (book review)
Nelson-Smith, A. 1977.
Marine Pollution Bulletin 8(3):71-72.

Oil spills, Tankers, Ports, Biological effects, Marine organisms, Shorelines, Marshes, Metula spill, UK, *Milford Haven

The author reviews the book, "Marine Ecology and Oil Pollution" (J. M. Baker (ed.). Barking, Essex, Applied Science Publishers, 1976. 566p.), a collection of three published proceedings of the Oil Pollution Research Unit of the Field Studies Council. The majority of the text deals with the Milford Haven oil port and the effects of tanker traffic on the plankton, birds, and seals of the rocky shores and salt marshes. Also included are accounts of the "Metula" spill and 216 other oil spillages reported over the last 15 years.

C-1403-77
CHEMICAL COMPOSITION AND EFFECTS OF WATER EXTRACTS OF PETROLEUM ON EGGS OF THE SAND DOLLAR MELITTA QUINQUIESPERFORATA
Nicol, J. A. C., W. H. Donahue, R. T. Wang, and K. Winters. 1977.
Marine Biology 40(4):309-316.

Toxicity, Crude oil, Fuel oil, Marine organisms, Echinoderms, *Sand dollars

The effects of Kuwait crude and No. 2 fuel oils on the sperm and eggs of the sand dollar, Melitta quinquiesperforata were determined. Water soluble fractions of No. 2 fuel oil depressed respiration, inhibited the mobility of sperm, interfered with fertilization and cleavage, and retarded larval development. Kuwait crude was much less toxic, showing interference at the first cleavage stage only.

C-1404-77
THE EFFECTS OF OILS AND OIL COMPONENTS ON ALGAE: A REVIEW
O'Brien, P. Y., and P. S. Dixon. 1976.
British Phycological Journal 11(2):115-142.

Algae, Biological effects, Metabolism, Uptake, *Photosynthesis, *Respiration

Physiological effects of oil are discussed under the headings of (1) physical and chemical factors; (2) photosynthesis; (3) respiration; (4) accumulation; and (5) nucleic acids. Exposure to oil has been shown to cause a depressive effect on algal photosynthesis and to result in aquatic biotas of reduced diversity. However, it appears in general that algae are able to withstand the effects of oil more effectively than susceptible animals.

[from Applied Ecology Abstracts 3(1):#3D860. 1977]

C-1405-77
THE CHANGING BIOCHEMISTRY OF THE SEA
O'hEocha, C. 1976.
Technology Ireland 8(1):18-21.

Marine organisms, Contamination, Biological effects, *Metabolic interactions

Organic compounds in marine organisms affect the regulation of the growth of organisms, the chemical alteration of constituents of other organisms, and the transmission of signals between organisms. If these interactions are interrupted, stress is placed on the individual organisms. For example, petroleum pollution threatens marine life by interfering with the facilities for chemoreception which enables organisms to detect food or sexual partners.

[from Oceanic Abstracts 14(1):#77-00674. 1977]

C-1406-77
ECOLOGICAL ASPECTS OF THE GLOBAL POLLUTION OF MARINE ENVIRONMENT
[English summary]
Patin, S. A., 1976.
Okeanologiya 16(4):621-626.

Contamination, Oceans, Petroleum products, Biological effects, Food web, Phytoplankton

The sources and the degree of world ocean pollution by petroleum and petroleum products are presented; petroleum concentration levels are reported for both pelagic and shelf waters. The food web may be in danger due to a decrease in photosynthetic intensity and in the biomass of phytoplankton leading to a decrease in nekton production.

[from Aquatic Sciences and Fisheries Abstracts 7(2):#7Q1876. 1977]

C-1407-77
OIL SPILLS: EFFECTS OF PETROLEUM ON MARINE ORGANISMS (letter to editor)
Payne, J. F. 1977.
Science 196(4285):10.

Oil spills, Biological effects, Chronic effects, Marine organisms

The letter supports P. H. Abelson's editorial, "Oil Spills," [Science 195(4274):137] which in part questioned the reported disastrous effects of oil spills. The writer's own field and laboratory studies involving the effects of chronic exposure of fish and other organisms to petroleum hydrocarbons has in no case suggested that petroleum is a very harmful substance.

C-1408-77
SUBLETHAL EFFECTS - EFFECTS ON SEA GRASS
Pearson, J. D. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 8. p.377-389.

Hydrocarbons, Biological effects, Plants, Food web, *Photosynthesis, **Zostera marina*

The effects of selected petroleum hydrocarbons on rates of photosynthesis in *Zostera marina* are evaluated in an attempt to understand the effects of plant exposure to low levels of hydrocarbons and its consequences to food chains.

[from Selected Water Resources Abstracts 10(4):#W77-01874. 1977]

C-1409-77
RESPONSES OF ARCTIC MARINE BENTHIC CRUSTACEANS TO SEDIMENTS CONTAMINATED WITH CRUDE OIL
Percy, J. A. 1977.
Environmental Pollution 13(1):1-10.

Crude oil, Crustaceans, Biological effects, Sediments, Benthos, Arctic, *Amphipods, *Isopods

The responses of several arctic marine benthic crustaceans to sediments experimentally contaminated with 4 different crude oils were tested. The amphipod, *Onisimus affinis*, showed a strong avoidance to oiled sediments. This response was most pronounced at low oil concentrations (0.05 ml/15g dry sediment), markedly impaired at higher oil concentrations, and completely abolished at the highest concentrations tested (2 ml/15 g dry sediment). Weathering of the oil for 1 week reduced the avoidance response. Other amphipod and isopod species tested did not respond consistently between oil-tainted and clean sediments.

C-1410-77

EFFECTS OF CRUDE OILS ON ARCTIC MARINE INVERTEBRATES

Percy, J. A., and T. C. Mullin. 1975.
Canada Department of the Environment, Beaufort Sea technical report, No. 11. 167p.

Crude oil, Marine organisms, Arctic, Invertebrates, Biological effects, Behavior, Metabolism

Oil-animal interactions in sub-ice, neritic and benthic habitats are considered and biological effects of three general types are examined: short term lethal effects, sublethal physiological effects, and behavioral effects. Lethal toxicity studies indicate a relatively high tolerance level for crude oil among most of the species examined. However, activity and metabolism may be severely impaired by exposure to relatively low oil levels. In behavioral studies, some marine species such as *Onisisus* avoided oil masses and oil-tainted food and preferentially selected uncontaminated sediment. In constrast, other species such as *Mesidotea* exhibited no preference for either oil-containing or oil-free food and sediment.

C-1411-77

EFFECTS OF CRUDE OIL ON THE LOCOMOTORY ACTIVITY OF ARCTIC MARINE INVERTEBRATES

Percy, J. A., and T. C. Mullin. 1977.
Marine Pollution Bulletin 8(2):35-40.

Toxicity, Crude oil, Invertebrates, Arctic, *Amphipod, *Coelenterate

Reported are effects of northern crude oils on the locomotory activity of two Arctic marine invertebrates: the amphipod, *Onisimus affinis*, and the coelenterate, *Halitholus cirrattus*. The ecological implications of such sublethal effects are discussed. Low concentrations of the oils significantly impaired activity in both species.

C-1412-77

THE EFFECTS OF THREE OILS ON THE GROWTH OF THE DINOFLAGELLATE *DUNALIELLA TERTIOLUCTA* AND THE DIATOM *FRAGILARIA* SP. IN AXENIC BATCH CULTURES

Prouse, N. J., and D. C. Gordon, Jr. 1974.
Copenhagen, International Council for the Exploration of the Sea, Fisheries Improvement Committee, 1974. 6p.

Phytoplankton, Biological effects, *Dinoflagellates, *Diatoms

Summary not available.

[from On Effects of Oil Pollution in Arctic and Subarctic Waters. Northwest Marine Fisheries Center. September, 1976]

C-1413-77

SURVEY UPON THE GROUPS OF FISH-TOXIC SUBSTANCES IN WATER

Reichenbach-Klinke, H. H. 1976.
The Influence of Environmental Factors upon the Health of Fishes. H. H. Reichenbach-Klinke (ed.). Stuttgart, GFR, G. Fischer Verlag, 1976. p.3-7. Presented at the MÜnchener Fischereibiologisches Seminar, Munich, March 18-20, 1975.

Toxicity, Fish, Petroleum products, Petrochemicals

The following groups of fish-toxic substances in water are listed and discussed: metals, non-metallic elements, oils and oil derivatives, pesticides, detergents, biphenyls, antibiotics, sulfonamides, and biotoxins.

[from Aquatic Sciences & Fisheries Abstracts 7(3):#7Q3118. 1977]

C-1414-77

ACUTE AND CHRONIC TOXICITY, UPTAKE AND DEPURATION, AND SUBLETHAL METABOLIC RESPONSE OF ALASKAN MARINE ORGANISMS TO PETROLEUM HYDROCARBONS.

Rice, S. D., and J. F. Karinen. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Invertigators' Reports for the Year Ending March 1976. Vol. 8. p.25-47.

Crude oil, Toxicity, Marine organisms, Acute effects, Chronic effects, Metabolism, Alaska

The acute and chronic toxicity of crude oil on physiological and behavioral mechanisms of various arctic and subarctic marine organisms was determined, and the recovery rates of the selected organisms in laboratory and field studies were reported. Temperature was found to have little effect on toxicity.

[from Selected Water Resources Abstracts 10(4):#W77-01866. 1977]

C-1415-77

EFFECT OF PETROLEUM HYDROCARBONS ON BREATHING AND COUGHING RATES, AND HYDROCARBON UPTAKE-DEPURATION IN PINK SALMON FRY

Rice, S. D., R. E. Thomas, and J. W. Short. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 8. p.88-118.

Crude oil, Fuel oil, Toxicity, Hydrocarbons, Fish, Alaska, *Respiration rate, **Oncorhynchus gorbuscha*

Breathing and coughing rates of pink salmon fry, *Oncorhynchus gorbuscha*, were monitored during exposure to water soluble fractions of Cook Inlet and Prudhoe Bay crude oils and No. 2 fuel oil. High breathing rates during the first 24 hours of exposure, elimination of most aromatics by 20 hrs, and the continued high breathing during a constant-dose exposure for 72 hrs indicate that salmon fry can cope with a sublethal exposure to hydrocarbons, but at the cost of an increased metabolic rate. Increased metabolic rates may be detrimental to survival if the stress persists for long periods of time.

[from Selected Water Resources Abstracts 10(4):#W77-01868. 1977]

C-1416-77
ACCUMULATION AND RELEASE OF FUEL-OIL-DERIVED DIAROMATIC HYDROCARBONS BY THE POLYCHAETE NEANTHES ARENACEODENTATA
Rossi, S. S., and J. W. Anderson. 1976.
Marine Biology 39(1):51-55.

Aromatic hydrocarbons, Fuel oil, Polychaetes, Uptake, Release, *Naphthalene, *Neanthes arenaceodentata

Male and female Neanthes arenaceodentata were exposed to a sublethal concentration of No. 2 fuel oil for 24 hours; within one hour both sexes incorporated most of the diaromatic hydrocarbons eventually accumulated. In hydrocarbon-free seawater male worms released naphthalenes for 17 days to a level below 0.1 ppm, whereas gravid females retained the hydrocarbons for three weeks until the release of their eggs during fertilization. Larvae contained high concentrations of naphthalenes until they developed into 32-segment worm juveniles.

C-1417-77
SPIN-LABELING TECHNIQUES FOR STUDYING MODE OF ACTION OF PETROLEUM HYDROCARBONS ON MARINE ORGANISMS
Roubal, W. T., and T. K. Collier. 1975.
Fishery Bulletin 73(2):299-305.

Hydrocarbons, Biological effects, Marine organisms, Analytical techniques, *Spin-labeling techniques

The aim of spin-labeling studies of membrane-contaminant interaction is to gain a better understanding of the mode of action of hydrocarbon contaminants at the molecular level. Basic spin labeling theory together with experimental results from the study are presented and discussed.

C-1418-77

EFFECTS OF OUTBOARD MARINE ENGINE EXHAUST ON THE AQUATIC ENVIRONMENT

Schenk, J. E., P. F. Atkins, Jr., R. L. Weitzel, P. B. Simon,
J. C. Posner, and W. J. Weber, Jr. 1976.
Seventh International Conference on Water Pollution Research.
Technical papers. S. H. Jenkins (ed.). Oxford, Pergamon Press,
1976. p.733-741.

Biological effects, Hydrocarbons, Lakes, Phytoplankton,
*Outboard marine engine exhaust

No acute effects on any of the biological communities were observed. Species abundance, richness, and similarity of the phytoplankton populations in both leaded and nonleaded fuel test lakes were not affected by two-cycle motorboat engines. Aromatic hydrocarbons released into the water were rapidly removed by evaporation; increases in other hydrocarbons in both the water column and sediments were observed in both test lakes.

[from ERDA Energy Research Abstracts 2(6):#14801. 1977]

C-1419-77

ACUTE EFFECTS - PACIFIC HERRING ROE IN THE GULF OF ALASKA

Smith, R. L., J. G. Pearson, and J. A. Cameron. 1976.
Environmental Assessment of the Alaskan Continental Shelf.
Principal Investigators' Reports for the Year Ending March 1976.
Vol. 8. p.325-343.

Crude oil, Toxicity, Fish, Acute effects, Fisheries, Offshore
development, Gulf of Alaska, *Pacific herring

The toxicity of water-soluble components of crude oil under simulated natural conditions was measured in terms of hatching success and gross morphological abnormalities of the Pacific herring. Since many of the roe are deposited in the intertidal zone, the presence of oil on the water and beach will cause a general increase in mortality. Spills or seepage during the three to four week reproductive period could have significant impact on egg and larval mortality.

[from Selected Water Resources Abstracts 10(4):#W77-01872. 1977]

C-1420-77
EFFECTS OF CONTACT AND INGESTION OF CRUDE OIL ON RINGED SEALS
Smith, T. G., and J. R. Geraci. 1975.
Canada Department of the Environment, Beaufort Sea Project technical report, No. 5. 66p.

Toxicity, Crude oil, Marine mammals, Acute effects, *Ringed seals

The effects of immersion in oil and ingestion of oil on ringed seals and harp seal pups were evaluated. Techniques used in the laboratory and field studies are detailed, and the results are tabulated and discussed. Immersion caused reversible damage to eyes; oil ingestion resulted in enzymatic and histologic damage to kidney and liver. Results of these studies are extrapolated to evaluate the potential effects of oil on seal habitats during different seasons.

C-1421-77
BIOLOGICAL EFFECTS OF INDUSTRIAL AND DOMESTIC WASTE DISCHARGE IN COASTAL WATERS
Soudan, M. 1975.
Progress in Water Technology 7(5-6):985-999.

Wastewaters, Industries, Hydrocarbons, Marine organisms, Ecosystems, Coasts

A general review is presented of the effects of industrial and domestic pollutants, including petroleum hydrocarbons, upon marine invertebrates, plants, and the coastal marine ecosystem.

C-1422-77
A DESCRIPTIVE EVALUATION OF THE EFFECTS OF NO. 2 FUEL OIL ON THE TISSUES OF THE SOFT SHELL CLAM, MYA ARENARIA L.
Stainken, D. M. 1976.
Environmental Contamination and Toxicology 16(6):730-738.

Fuel oil, Biological effects, Mollusks, *Clams, *Mya arenaria

Tissue changes did not occur in Mya arenaria after four weeks exposure to No. 2 fuel oil, but depletion of glycogen and generalized leukocytosis were noted, particularly in the blood sinuses of the pallium and mantle membrane. An increase in vacuolization of the diverticula, stomach, and intestines, as well as an altered respiration rate, were observed.

C-1423-77
THE EFFECT OF A NO. 2 FUEL OIL AND A SOUTH LOUISIANA CRUDE OIL ON THE BEHAVIOR OF THE SOFT SHELL CLAM, *MYA ARENARIA* L.
Stainken, D. M. 1976.
Environmental Contamination and Toxicology 16(6):724-729.

Toxicity, Crude oil, Fuel oil, Mollusks, Metabolism, *Clams, **Mya arenaria*

The effects of crude and refined oil on the behavior of *Mya arenaria* were investigated and LC_{50} bioassay values were obtained for 96 hour and seven day exposure periods. Both crude and fuel oil caused high mucus secretion and decreased tactile response in the clam; the increase in mucus production lead to an increased metabolic demand and disruption of normal physiological processes at lower oil concentrations than the LC_{50} indicated.

C-1424-77
EFFECTS OF A SPILL OF MARINE DIESEL OIL ON THE ROCKY SHORE FAUNA OF LAMMA ISLAND, HONG KONG
Stirling, H. P. 1977.
Environmental Pollution 12(2):93-117.

Fuel oil, Oil spills, Toxicity, Mollusks, Acute effects, Chronic effects, Intertidal zone, *Hong Kong

About 2500 tons of heavy marine diesel oil were spilled near Lamma Island, Hong Kong. Acute toxic and long term effects of the oiling on common littoral fauna were assessed in the field, and long term recovery studies using clean seawater were conducted in the laboratory. Acute mortality of gastropods was greatest in areas of moderate contamination where a dispersant was used, but chronic effects were more severe in a heavily oiled area where no dispersant was applied. Bivalves and gastropods found in the laboratory to be least sensitive to oil showed no signigicant long term reductions in population.

[from Pollution Abstracts 8(3):#77-02499. 1977]

C-1425-77
ACCOUNT OF OIL POLLUTION DAMAGING THE SEABIRDS IN GDAŃSK BAY [English summary]
Szczepski, J. B. 1976.
Przeglad Zoologiczny 20(1):75-81.

Crude oil, Birds, Contamination, Statistics, Baltic Sea, *Mortality, *Gdańsk Bay

Observations and statistics dealing with the seabirds perishing between 1947-1970 due to oil pollution in Gdansk Bay, Baltic Sea, are reported. The longtailed ducks, velvet scooters, gulls, and auks suffered the highest fatalities. With increasing pollution by crude oil, the percentage of oil damaged birds is expected to rise.

[from Aquatic Sciences and Fisheries Abstracts 7(2):#7Q1901. 1977]

C-1426-77

RESPONSE OF THE CLAM, *MACOMA BALTHICA* (LINNAEUS), EXPOSED TO PRUDHOE BAY CRUDE OIL AS UNMIXED OIL, WATER-SOLUBLE FRACTION, AND SEDIMENT-ADSORBED FRACTION IN THE LABORATORY

Taylor, T. L., J. F. Karinen, and H. M. Feder. 1976.
Environmental Assessment of the Alaskan Continental Shelf.
Principal Investigators' Reports for the Year Ending March 1976.
Vol. 8. p.48-87.

Crude oil, Biological effects, Mollusks, Sediments, Alaska, *Clams, *Indicator species, **Macoma balthica*

The response to crude oil by *Macoma balthica* under laboratory conditions is presented. Oil allowed to settle over buried *M. balthica* stimulated their movement to the surface; the proportion of clams that moved to the surface increased as the depth of oil-contaminated sediment increased. *M. balthica* can be used as an indicator species of the effect of oil in the sediment environment.

[from Selected Water Resources Abstracts 10(4):#W77-01867. 1977]

C-1427-77

FUNDAMENTAL STUDIES ON THE INFLUENCE OF OIL POLLUTION UPON MARINE ORGANISMS - I. LETHAL CONCENTRATIONS OF OIL-SPILL EMULSIFIERS FOR SOME MARINE PHYTOPLANKTON

Tokuda, H., and S. Arasaki. 1977.
Bulletin of the Japanese Society of Scientific Fisheries 43(1): 97-102.

Emulsifiers, Toxicity, Phytoplankton, Marine organisms

The lethal concentrations of 84 commercially produced oil spill emulsifiers were determined experimentally for three species of marine phytoplankton. The toxicity of the emulsifiers was reduced year after year due to improvements in their components. The most recently produced oil spill emulsifiers did not inhibit growth at concentrations of 100 ppm.

C-1428-77
AN ASSESSMENT OF THE EFFECTS OF POLLUTION ON FISHERIES AND AQUACULTURE IN JAPAN
Tokyo University of Fisheries. 1976.
FAO-FIR/T--163. 105p.

Contamination, Fisheries, Chronic effects, Japan, *Tokyo Bay, *Seto Inland Sea

A study of Tokyo Bay and Seto Inland Sea found oil pollution to be the main cause of damage to fisheries, although no significant decrease in total catch was observed. Direct damage and catch reports indicate that species composition may have changed due to chronic oil pollution.

[from Aquatic Sciences and Fisheries Abstracts 7(2):#7Q1862. 1977]

C-1429-77
EFFECT OF PETROLEUM HYDROCARBONS ON ALGAL PHYSIOLOGY: REVIEW AND PROGRESS REPORT
Vandermeulen, J. H., and T. P. Ahern. 1976.
Society of Experimental Biology Seminar Series 2 (Effects of Pollutants on Aquatic Organisms):107-125.

Hydrocarbons, Algae, Biological effects, Metabolism, *Naphthalene

In three different marine unicellular algae, naphthalene depression of CO_2 fixation was dose-dependent and resulted in similar patterns of inhibition in Fragilaria, Monochrysis lutheri, and Dunaliella. The algae appear to be highly sensitive to small changes in trace quantities of naphthalene and the CO_2 fixation is bimodal with differential inhibition observed at low and high concentrations.

[from Chemical Abstracts 86(9):#51367h. 1977]

C-1430-77
THE COMPARATIVE TOXICITIES OF CRUDE OILS, REFINED OIL PRODUCTS AND OIL EMULSIONS
Van Gelder-Ottway, S. 1976.
Marine Ecology and Oil Pollution. J. M. Baker (ed.). New York, John Wiley & Sons, 1976. p.287-302. Institute of Petroleum/ Field Studies Council Meeting, Aviemore, Scotland, 1975.

Toxicity, Crude oil, Fuel oil, Emulsions, Dispersants, Mollusks, UK

Experiments were conducted to determine the toxicities of crude oils, refined oil products, and oil emulsions to intertidal mollusks common to British shores. Oil products with low boiling points were found to be more toxic than heavy fuel oils, while crude oils had intermediate toxicity. The toxicity of mixtures of crude oils and dispersants was also investigated; no simple relationship was found between the toxicity of the mixtures and that of the oil or dispersants alone.

C-1431-77
EFFECT OF TEMPERATURE ON THE SENSITIVITY OF YOUNG STURGEONS TO PETROLEUM POISONING [in Russian]
Velikhanov, Eh. E. 1976.
Izvestiya. Akad. Nauk Azerbaidzhanskoi S.S.R. (Biol.) No. 1. 92-96.

Contamination, Fish, *Temperature effects, *Sturgeons

In this experimental study, 100% mortality of juvenile great sturgeon was recorded at 30.30°C, while at 21.88-27.25°C the mortality was almost nine times lower. The petroleum concentration of 75 ml/l was found to be lethal for 13-day-old great sturgeon, while 47-day-olds showed fairly high resistance to this concentration. Experiments showed a decrease in maximum tolerated oil pollution levels with an increase in water temperature.

[from Aquatic Sciences & Fisheries Abstracts 7(3):#7Q3139. 1977]

C-1432-77
PHYSIOLOGICAL RESPONSES OF MARINE BIOTA TO POLLUTANTS
Vernberg, F. J., A. Calabrese, F. T. Thurberg, and W. B. Vernberg (eds.). 1977.
New York, Academic Press, Inc., 1977. 482p.

Contaminants, Marine organisms, Petroleum products, Biological effects, *Physiological response

Papers at a symposium on physiological responses of marine biota to pollutants are presented. Pollutants covered include pesticides, PCB's, heavy metals and petroleum products.

[from Marine Biology 39(4):advertisement. 1977]

C-1433-77
ACUTE TOXICITY OF OIL DISPERSANTS TO MARINE FISH LARVAE
Wilson, K. W. 1977.
Marine Biology 40:65-74.

Dispersants, Toxicity, Fish, Acute effects, Solvents, *Fish larvae

Acute toxicities of oil dispersants to the larvae of herring, haddock, lemon sole, pilchard, plaice, and sole were examined. The type and aromatic content of the solvent were found to be the main factors influencing toxicity. Aging of the dispersants led to a decrease in toxicity which could be related to the loss of aromatic compounds. Temperature and salinity had only a slight influence on toxicity. The transition period from yolk reserves to an external food supply was critical; once larvae had established feeding, resistance increased until metamorphosis.

C-1434-77

PHENALEN-1-ONE: OCCURRENCE IN A FUEL OIL AND TOXICITY TO MICROALGAE

Winters, K., J. C. Batterton, and C. Van Baalen. 1977.
Environmental Science and Technology 11(3):270-272.

Toxicity, Fuel oil, Algae, *Growth rates, *Phenalen-1-one

Phenalen-1-one, isolated from the water soluble fraction of a No. 2 fuel oil, had two different effects on the growth of microalgae. With blue-green algae toxicity occurred at 5 ppm and was independent of wavelength, whereas with green algae toxicity was wavelength-dependent. In white light 250 ppb was lethal; with this same light screened by a yellow filter (530 nm), toxicity occured at 10 ppm.

C-1435-77

EFFECT OF CRUDE PETROLEUM OIL ON CLAMS. PART 1 [in Korean]

Yi, P., and T. Yi. 1975.
Bulletin of the Korean Fisheries Society 8(4):252.

Crude oil, Biological effects, Mollusks, *Clams

Summary not available.

[from Bioresearch Index 13(1):#1089. 1977]

C-1436-77

EFFECT OF CRUDE PETROLEUM OIL ON CLAMS. PART 2 [in Korean]

Yi, P., and P. Chin. 1975.
Bulletin of the Korean Fisheries Society 8(4):252.

Crude oil, Biological effects, Mollusks, *Clams

Summary not available.

[from Bioresearch Index 13(1):#1090. 1977]

2. PHYSICAL EFFECTS

C-1437-77
ON THE DECREASE IN REAERATION COEFFICIENT DUE TO COVERING OF WATER SURFACE WITH OIL
Arai, N., Y. Hayashi, and S. Sugiyama. 1976.
Lippon Kagaku Kaishi 8(8):1315-1318.

Oil slicks, Physical effects, *Reaeration rates

The reaeration rate of pure water and that of water covered with oil was investigated. Findings are as follows: the reaeration coefficient, K_2, is affected by the presence of oil slicks and decreases by approximately 20-40% on water without oil slicks; the temperature coefficient, θ, is 1.041 in the presence of oil slicks, and 1.028 without them; in the experimental temperature range of 6° to 40.5°C, the equilibrium concentration of dissolved oxygen maximally changes with the amount of oil slicks within a limit of ± 10%.

[from Aquatic Sciences & Fisheries Abstracts 7(3):#7Q3148. 1977]

C-1438-77
A WIND WAVE TUNNEL FOR THE INVESTIGATION OF ARTIFICAL SLICK WAVE DAMPING AND DRIFT
Huehnerfuss, H. 1976.
Meerestechnik. Marine Technology 7(1):23-26.

Oil slicks, Fate, Drift, Oceans, *Wave damping, *Wind wave tunnel

Initial work with the SFB 94 wind wave tunnel, located in Hamburg, concerns monomolecular surface active oil films and their ability to dampen capillary waves and thereby interfere with wind wave generation mechanisms. The drift properties of these films under wind and wave action are being investigated.

[from Oceanic Abstracts 14(1):#77-0518. 1977]

3. ECONOMIC EFFECTS

C-1439-77
RECESSION PROVIDES INSURERS WITH A BREATHING SPACE
Averill, G. 1976.
Tanker & Bulker International 2(1):11,20.

Insurance, *Marine industry, Tankers, Liability

In 1975, the marine insurance industry was depressed by inflation in repair costs, unfair competition, substandard ships and crews, difficulties with ship repairs, and pollution liability. The International Convention on Civil Liability for Oil Pollution Damage (1969) requires tankers carrying > 2,000 tons of persistent oil to have a certificate of insurance. This created a major insurance market and may produce more competitive rates through more underwriters.

[from Oceanic Abstracts 14(2):#77-01874. 1977]

C-1440-77

AN INTEGRATED INDUSTRY MODEL OF PETROLEUM REFINING, ELECTRIC POWER, AND CHEMICAL INDUSTRIES FOR COSTING POLLUTION CONTROL AND ESTIMATING ENERGY PRICES
Calloway, J. A., and R. G. Thompson. 1976.
Engineering Process Econ. 1(3):199-216.

Refineries, Wastewaters, Pollution control, Models, Economic effects, *Industry costs

This paper reviews detailed work presented in three monographs and gives key examples of how technical information may be synthesized into a comprehensive economic model to evaluate the industry cost, market price, and economic impact of restrictive waste discharge standards for the petroleum refining, electric power, and important chemical industries.

[from Environmental Health and Pollution Control 11(6):#1250. 1977]

4. GENERAL EFFECTS

C-1441-77

CASE OF SUBSURFACE WATER POLLUTION BY PETROLEUM PRODUCT WASTES [in Russian]
Anan'Ev, N. I., A. A. Kyuregyan, and L. A. Rybina. 1975.
Gigiena i Sanitariya No. 10:97-98.

Petroleum products, Contamination, Groundwater, Oil tanks, Chemical analysis, USSR

A history of groundwater contamination by petroleum waste products is given. Petroleum wastes were able to leak out of metal storage tanks and penetrate along the fissures to the groundwater level where the city of Alekseevka, USSR, obtains potable water. Chemical analysis revealed a decrease in petroleum products over a period of two years following storage tank repair.

[from Selected Water Resources Abstracts 10(5):#W77-02273. 1977]

C-1442-77
AQUATIC POLLUTION AND LIVING RESOURCES [in Spanish]
Andrén, L. E. 1976.
Lectures given at the Third FAO/SIDA Training Course on Water Pollution in Relation to Protection of Living Resources. Scientific and Administrative Basis for Directive Action, Lima,Peru, 1975. Rome,UN Food and Agriculture Organization, 1976. 269p. FOA/SIDA/TF--9343-Supplement 1.

Contamination, Oil industry, Hydrocarbons, Dispersants, *Aquatic pollution

Pollution topics considered in this paper include: the dual aspect of eutrophication, hydrocarbons and oil dispersants, oil and petrochemical industry, organic and synthetic toxicants, heavy metals, thermal pollution, and others.

[from Aquatic Sciences & Fisheries Abstracts 7(3):#7Q3114. 1977]

C-1443-77
ANNUAL REPORT FOR 1975
Anon. 1976.
London, Advisory Committee on Oil Pollution of the Sea, 1976. 36p.

Oil spills, Pollution prevention, Pollution control

Summary not available.

[from Aquatic Sciences & Fisheries Abstracts 7(3):#7Q304S. 1977]

C-1444-77
ARGO'S LEGACY: BATCH OF OILY PANCAKES (news brief)
Anon. 1977.
Science News 111(15):230.

Argo Merchant spill, Fate, Atlantic Ocean, Biological effects, Marine organisms

The fate, behavior, and effects of the "Argo Merchant" spill of December, 1976, have been monitored and studied by a NOAA research team. Most of the oil floated out into the Atlantic in the form of large pancakes 15 to 27 m (50 to 90 ft) in diameter which shrank in area and thickened over time. Preliminary results of the biological effects include substantial contamination of zooplankton, near-surface organisms and fishes, with little apparent damage to marine birds and mammals.

C-1445-77
THE FUTURE OF CHESAPEAKE BAY. SYMPOSIUM HELD AT ARLINGTON, VIRGINIA ON APRIL 15, 1976
Anon. 1976.
Sponsored in part by National Wildlife Federation and Wildlife Management Institute. W77-04203. 136p.

Ships, Ports, Pollution control, Oil spills, Chesapeake Bay, *Symposium

Contents of the title symposium are; dynamics of Chesapeake Bay; Channelization and shipping; Ports--Baltimore in particular; Shore erosion and wetlands; Pollution and ecology.

[from Government Reports Announcements 77(10):#PB-263 457/4GA. 1977]

C-1446-77
IMCO/FAO/UNESCO/WMO/WHO/IAEA/UN JOINT GROUP OF EXPERTS ON THE SCIENTIFIC ASPECTS OF MARINE POLLUTION (GESAMP). REPORT OF THE EIGHTH SESSION, ROME, 21-27 APRIL 1976
Anon. 1976.
Rome, Food and Agriculture Organization of the UN, 1976. 33p. (Report Stud. GESAMP No. 4)

Contamination, Oceans, Environmental effects, Water quality, Offshore exploration

Specific topics covered include an evaluation of the hazards of harmful substances in the marine environment, a review of the harmful substances and particularly the impact of oil, the interchange of pollutants between the atmosphere and oceans, principles for developing coastal water quality criteria, and scientific aspects of pollution arising from the exploration and exploitation of the sea bed.

[from Aquatic Sciences & Fisheries Abstracts 7(3):#7Q2189. 1977]

C-1447-77
ONSHORE IMPACTS OF OIL AND GAS DEVELOPMENT IN ALASKA: VOL. II. METHODOLOGY APPENDICES
Anon. 1975.
Special report, PB-248 896. 162p.

Offshore development, Onshore impacts, Models, Alaska

A general model of oil and gas development is analyzed. Each of the components is defined and used as the basis for a series of assumptions which are used to map the model onto an individual area to yield a development alternative.

[from Environment Abstracts 7(1):#77-00177. 1977]

C-1448-77
MICROBIAL RELEASE OF SOLUBLE TRACE METALS FROM OIL IMPACTED SEDIMENTS
Barsdate, R. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 10. p.367-380.

Crude oil, Sediments, Offshore development, Release, Microorganisms, Environmental effects, *Trace metals

The initial results of laboratory experiments suggest that the copper concentration of sediment pore water may increase following the addition of oil, and tentatively the effect is ascribed to the occlusion of trace metal binding sites or exchange sites by components of the oil.

[from Selected Water Resources Abstracts 10(7):#W77-03225. 1977]

C-1449-77
OIL AND OIL DISPERSANTS
Carlberg, S. R. 1976.
Second FAO/SIDA Training Course on Marine Pollution in Relation to Protection of Living Resources: Methods for Detection, Measurement and Monitoring of Pollutants in the Aquatic Environment. Rome, UN Food and Agriculture Organization, 1976. p.28-35.

Oil discharges, Ships, Tankers, Contamination, Fate, Biological effects, Dispersants

Topics discussed include oil pollution from ships, effects and fate of oil pollution at sea, possible ways of dealing with released oil, and biological aspects of oil pollution.

[from Oceanic Abstracts 14(2):#77-01635. 1977]

C-1450-77
THE BATTLE AGAINST OIL POLLUTION AT SEA
Department of Trade, UK. 1976.
London, Marine Division, Department of Trade, 1976. 12p.

Pollution prevention, Oceans

Summary not available.

[from Aquatic Sciences & Fisheries Abstracts 7(2):#7Q1912. 1977]

C-1451-77

THE INCIDENCE AND TREATMENT OF OIL POLLUTION IN OIL PORTS

Dudley, G. 1976.
Marine Ecology and Oil Pollution. J. M. Baker (ed.). New York, John Wiley & Sons, 1976. p.27-40. Institute of Petroleum/Field Studies Council Meeting, Aviemore, Scotland, 1975.

Oil transfer, Ports, Pollution prevention, Leakage, Environmental effects, Spill cleanup, UK, *Milford Haven

The amount of oil pollution and its overall effect on the environment in seaports can be greatly reduced if loading and discharging procedures are carefully controlled and if planning ensures that equipment and labor are available to deal with oil spills. A case history of the Milford Haven port is presented and the effects of long-term leakage problems on the ecological status of the port are described.

C-1452-77

THE BALTIC SEA AS AN EXAMPLE FOR THE INTERACTION OF NATURAL AND MANMADE STRESS FACTORS

Grasshoff, K. 1975.
Thalassia Jugoslavica 11(1-2):1-17.

Baltic Sea, Ecosystems, Contaminants, Hydrocarbons, Environmental effects

Manmade stress factors influencing the Baltic ecosystem and their interaction with the unique natural features of the Baltic Sea are discussed. The morphologic structure of the sea, its highly stratified water structure, and its extremely limited water exchange with the ocean are related to the influx of pollutants including petroleum hydrocarbons.

[from Chemical Abstracts 86(10):#58380r. 1977]

C-1453-77

THE BLACK TIDE OF LA CORUNA. OIL SPILL OFF SPAIN

Gundlach, E. R., I. A. Fischer, and R. J. Stein. 1977.
Oceans 10(2):56-60.

Spill cleanup, Urquiola spill , Dispersants, Marine organisms, Environmental effects, Spain

The circumstances and major effects of an oil spill caused by the grounding and explosion of the tanker, "Urquiola", off La Coruna, Spain, in May,1976, are described. Various countermeasures that were applied, such as mechanical oil removal from beaches and marshes and the extensive use of dispersants at the spill site, are discussed. Short term effects of the spill on marine habitats and organisms, especially edible species, are reviewed.

C-1454-77
THE METULA OIL SPILL
Gunnerson, C. G., and G. Peter. 1976.
Boulder, Colorado, National Oceanic and Atmospheric Administration Environmental Research Laboratories, 1976. 37p. NOAA special report.

Metula spill, Crude oil, Environmental effects, Strait of Magellan

Short term and long-range environmental damage caused by the "Metula" supertanker grounding, which spilled over 50,000 tons of crude oil into the Strait of Magellan and onto beaches and tidal marshes of Tierra del Fuego, is described. Included are the background of the accident, a description of the environment, reasons why cleanup was not attempted, and a discussion of further research needs.

[from Petroleum Abstracts 17(9):#231,089. 1977]

C-1455-77
UPTAKE, DISTRIBUTION, AND DEPURATION OF ^{14}C-BENZENE IN NORTHERN ANCHOVY, ENGRAULIS MORDAX, AND STRIPED BASS, MORONE SAXATILIS
Korn, S., et al. 1976.
Fishery Bulletin 74(3):545-551.

Uptake, Release, Hydrocarbons, Fish, *Benzene, *Northern anchovy, *Striped bass

The title fish were exposed to sublethal concentrations of ^{14}C-benzene for 48 hours. Both fish exhibited a rapid uptake over a wide range of benzene concentrations in the water column with accumulation in anchovy being greater than that in striped bass. Results indicated that the release of hydrocarbons was through the liver, gallbladder, intestines, and colon.

C-1456-77
EXPERIENCE WITH POLLUTION IN CONTROLLED MARINE ECOSYSTEMS. APPLICATIONS TO PETROLEUM PRODUCTS [in French]
Lacaze, J. C. 1976.
Oceanis 2(Suppl.):1-115.

Petroleum products, Toxicity, *Controlled marine ecosystems

An in-situ experiment conducted in Dinard to evaluate the toxicity of petroleum pollutants is described. The size of the experimental tanks, the illumination and temperature, and the number of tanks needed to evaluate the effect of petroleum products are discussed.

[from Aquatic Sciences and Fisheries Abstracts 7(2):#7Q1863. 1977]

C-1457-77
MARINE ECOLOGY AND OIL POLLUTION. EDITED BY JENIFER M. BAKER (book review)
Mackie, P. R. 1977.
Estuarine and Coastal Marine Science 5(1):154-156.

Contamination, Oil spills, Refineries, Dispersants, Toxicity, Monitoring, *Book review

A critical review is presented of the book, Marine Ecology and Oil Pollution (Barking, Essex, Applied Science Publishers, 1976), which contains papers of a 1975 meeting held in Aviemore, Scotland. Environmental responsibility, biological and environmental effects of oil contamination spills, refinery effluents, dispersants, offshore monitoring, and toxicity testing were among the topics covered. The review states that the title of the book is misleadingly broad and that coverage of several important aspects of marine ecology and oil pollution are inadequate or entirely lacking.

C-1458-77
HYDROCARBONS IN THE OCEAN
Myers, E. P., and C. G. Gunnerson. 1976.
Boulder, Colorado, Maritime Administration and the National Oceanic and Atmospheric Administration Environmental Research Laboratories, 1976. 42p. MESA special report.

Hydrocarbons, Oceans, Marine organisms

Summary not available.

[from Environmental Conservation 4(1):78. 1977]

C-1459-77
MARINE POLLUTION HANDBOOK (book review)
Preston, A. 1977.
Nature 267(5607):188.

Contaminants, Fate, Biological effects, Environmental effects, Regulations, *Book review

The book, Marine Pollution (R. Johnson (ed.). London, Academic Press, 1977. 729p.), is critically reviewed. The first section of the book provides background information on the major categories of pollutants including oil and discusses their principal pathways and environmental effects. The second part deals with environmental problems related to specific pollutants. The third section reviews problems of measuring biological response to pollutants, and the fourth section addresses legal aspects of marine pollution regulations.

C-1460-77
OBSERVATIONS ON THE PROBLEMS OF POLLUTION IN SHATT AL-ARAB, IRAQ
Saad, M. A. H. 1976.
Revue Internationale D'Oceanographie Medicale 43:3-11.

Contamination, Rivers, Waste oil, Tankers, Oil transfer, Iraq, *Shatt al-Arab

Oil and oily wastes are the most important pollutants in Shatt al-Arab and cause the greatest damage to aquatic organisms. The main source of this pollution is from the filling of oil tankers entering the river.

[from Aquatic Sciences and Fisheries Abstracts 7(2):#7Q1841. 1977]

C-1461-77
SEDIMENTATION AND FOOD RESOURCES: ANIMAL-SEDIMENT RELATIONSHIPS
Saila, S. B. 1976.
Marine Sediment Transport and Environmental Management.
D. J. Stanley and D. J. P. Swift (eds.). New York, John Wiley & Sons, 1976. p.479-492.

Sedimentation, Benthos, Environmental effects, Oil spills, *Animal-sediment relationships

Benthic communities and various classification schemes for them are briefly reviewed. The discussion is presented under the following headings: historical background of bottom community studies; bottom deposits and organisms; community descriptions and classification schemes; sampling problems; relationship of faunal communities to the character of sediments and rates of sedimentation; and impacts of dredging, dumping, oil spills, and construction on animal-sediment relationships.

[from Oceanic Abstracts 14(1):#77-00665. 1977]

C-1462-77
OIL SPILL IN HONG KONG
Spooner, M. F. 1977.
Marine Pollution Bulletin 8(3):62-65.

Oil spills, Environmental effects, Fisheries, Plankton, Monitoring, China, *Hong Kong

Field studies were set up to follow tainting and depuration in fish farming after a large spill of toxic product oil in Picnic Bay, Hong Kong. The hydrography, water quality, oil in sands, and macro-and meio-fauna of the shores were monitored, and the possible effects of the oil on plankton and open-water fisheries are discussed.

C-1463-77
ORGANIC CHEMICAL POLLUTION: PETROLEUM, PESTICIDES, AND DETERGENTS
Stoker, H. S., and S. L. Seager. 1977.
Environmental Chemistry. J. O. M. Bockris (ed.). New York, Plenum Press, 1977. p.429-476.

Crude oil, Petroleum products, Contamination

"A review with 122 references."

[from Chemical Abstracts 86(21):#151099r. 1977]

C-1464-77
COASTAL ENVIRONMENTAL IMPACT ASSESSMENT: LESSONS FROM OIL SPILLS
Straughan. D. 1975.
The Present and Future of Coasts, Proceedings of the First Annual Conference of the Coastal Society, Arlington, Virginia, 1975. p.116-123.

Oil spills, Environmental effects, Coasts, Baseline studies, *Coastal impacts

Based on experience in assessing the aftermath of oil spills and establishing baselines, a problem-oriented cause and effect is proposed in the assessment of coastal environmental impacts. The marine science aspect of this problem is discussed and should provide data useful in future assessments.

[from Selected Water Resources Abstracts 10(9):#W77-04472. 1977]

C-1465-77
SOME PHYSICAL AND BIOLOGICAL EFFECTS OF OIL FILMS FLOATING IN WATER
Van Gelder-Ottway, S. 1976.
Marine Ecology and Oil Pollution. J. M. Baker (ed.). New York, John Wiley & Sons, 1976. p.255-277. Institute of Petroleum/ Field Studies Council Meeting, Aviemore, Scotland, 1975.

Oil slicks, Biological effects, Physical effects, Plants, Animals, *Oxygen exchange, *Temperature, *Light-reduction, *Rock pools

Special reference is given to the rock-pool environment in the title investigation. Experiments with simulated rock pools demonstrate that photosynthesis and animal activity may be reduced, oxygen levels decreased, and temperature increased if oil films are present. Experimental plants and animals generally survived during the period of exposure and later recovered in clean seawater. Effects of oxidation on rate of oxygen exchange in waters covered by an oil film are minimal on the open sea and maximal in still water such as rock pools. Temperature and light-reduction effects follow a similar pattern.

C-1466-77
MAN'S IMPACT ON THE CHEMISTRY OF BISCAYNE BAY
Waite, T. D. 1976.
Biscayne Bay: Past, Present, and Future. A Thorhaug (ed.).
Coral Gables, Florida, University of Miami, 1976. p.279-285.
Biscayne Bay Symposium, Coral Gables, April 2, 1976.

Water quality, Contamination, Florida coast, *Human impact, *Biscayne Bay

Three years of water quality data for Biscayne Bay were evaluated with respect to man's impact and no real trends have been identified. Pollution inputs to the Bay are probably due to runoff water from metropolitan areas. In addition to data presented on stormwater runoff and specific metals, values for oil and grease in a canal system are shown as indicators of contamination from motor craft operation.

D. EFFECTS OF OIL EXPLORATION AND PRODUCTION

1. BIOLOGICAL EFFECTS

C-1467-77
PHYTOPLANKTON STUDIES - BERING SEA
Alexander, V. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 7. p. 163-210.

Monitoring, Phytoplankton, Ice, Offshore development, Biological effects, Food web, Bering Sea, Baseline studies

The dynamics of phytoplankton populations were studied, particularly along the edge of the seasonal ice-pack in the Bering Sea. Emphasis was on understanding seasonal variations in phytoplankton primary production, and possible effects of OCS oil development on phytoplankton populations and the food chain.

[from Selected Water Resources Abstracts 10(4):#W77-01851. 1977]

C-1468-77
API STUDY INDICATES PLATFORMS NOT HARMFUL TO MARINE LIFE (news brief)
Anon. 1977.
Sea Technology 18(2):35.

Offshore production, Platforms, Environmental effects, Marine organisms, Natural seepage, API

An API five year study indicates that the population levels and diversity of marine life do not seem to be affected by low level exposure to crude oil from offshore platform operations or from natural seeps. Contaminated marine organisms rapidly purge themselves of oil and growth and reproductive rates are not affected by low-level chronic exposure to oil.

C-1469-77
BEAUFORT SEA ESTUARINE FISHERY STUDY
Bendock, T. N. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigator's Reports for the Year Ending March 1976. Vol. 7. p. 243-261.

Monitoring, Estuaries, Fisheries, Distribution, Offshore development, Biological effects, Beaufort Sea, Baseline studies

Baseline data on the distribution, life histories and relative abundance of nearshore marine species of the Beaufort Sea were gathered in order to help minimize adverse effects of oil development activities in nearshore marine environments.

[from Selected Water Resources Abstracts 10(4):#W77-01854. 1977]

C-1470-77
WATER BIRDS AND THEIR WETLAND RESOURCES IN RELATION TO OIL DEVELOPMENT AT STORKERSEN POINT, ALASKA
Bergman, R. D., R. L. Howard, K. F. Abraham, and M. W. Weller. 1977.
U.S. Fish and Wildlife Service Resource Publication No. 129. 38 p.

Oil fields, Development, Coasts, Birds, Environmental protection, Alaska, Prudhoe Bay, *Tundra wetlands.

Water-related birds and tundra wetlands dominate the natural ecosystem of the Alaska coastal plain at Storkersen Point, near the Prudhoe Bay oil fields. This report classifies the tundra wetlands into eight types and relates them to bird use and populations. Based on these relationships, recommendations are made to protect the most valuable wetlands and to reduce conflicts between water birds and oil-gas development and related construction activities.

C-1471-77
LITTORAL SURVEY OF THE BEAUFORT SEA
Broad, A. C. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 7. p. 579-591.

Monitoring, Habitat, Marine organisms, Coasts, Beaufort Sea, Offshore development, Biological effects, Baseline studies

Habitats and ecological relationships along the Beaufort Sea coastline were surveyed and characterized in order to assess the risks of OCS oil-gas development, and to furnish baseline data for planning further research. Principal nearshore epifauna of the Beaufort Sea were found to be crustaceans; principal infaunal animals were mollusks and polychaetes. Biological data on these organisms are presented and discussed.

[from Selected Water Resources Abstracts 10(4):#W77-01862. 1977]

C-1472-77
THE NATURAL HISTORY AND ECOLOGY OF THE BEARDED SEAL (ERIGNATHUS BARBATUS) AND THE RINGED SEAL (PHOCA (PUSA) HISPIDA)
Burns, J. J., and T. J. Eley, Jr. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 1. p. 263-294.

Monitoring, Marine mammals, Biological effects, Offshore development, Bering Sea, Beaufort Sea, *Bearded and ringed seals, *Ecology

The natural history and ecology of the bearded and ringed seals of the Bering and Beaufort Seas were investigated in order to recognize how, when, where, and why certain oil and gas development activities may have acute or long-term effects on these two species which occupy different ecological niches. The ringed seal is small, abundant and widely distributed, occurs on stable sea ice, and feeds on zooplankton; whereas the bearded seal is large, widely distributed, occurs on drifting ice and feeds on benthic organisms.

[from Selected Water Resources Abstracts 10(4):#W77-01832. 1977]

C-1473-77
AN AERIAL CENSUS OF SPOTTED SEALS, PHOCA VITULINA LARGHA
Burns, J. J., and S. J. Harbo, Jr. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 1. p. 295-302.

Marine mammals, Biological effects, Offshore development, Distribution, Bering Sea, *Spotted seal, Baseline studies

The distribution, density, and total number of spotted seals have been reported in order to evaluate the potential impact of outer continental shelf oil and gas development in the proposed Bristol Bay, St. George Basin, and Navarin Basin lease areas. The spotted seal is restricted to the ice front in these bodies of water during late winter and spring.

[from Selected Water Resources Abstracts 10(4):#W77-01833. 1977]

C-1474-77
THE RELATIONSHIPS OF MARINE MAMMAL DISTRIBUTIONS, DENSITIES AND ACTIVITES TO SEA ICE CONDITIONS
Burns, J. J., L. H. Shapiro, and F. H. Fay. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 1. p. 387-430.

Biological effects, Offshore development, Marine mammals, Habitat, Ice, Distribution, Bering Sea, Beaufort Sea, Baseline studies

The effects of petroleum development in the Bering, Chukchi, and Beaufort Seas on ice-associated marine mammals are reported. An attempt is made to determine what major habitats exist, how these habitats are spatially distributed, to what extent the mammals depend on them, and how the biology of marine mammals relate to physical changes in their ice environment.

[from Selected Water Resources Abstracts 10(4):#W77-01838. 1977]

C-1475-77
POPULATION ASSESSMENT, ECOLOGY AND TROPHIC RELATIONSHIPS OF STELLER SEA LIONS IN THE GULF OF ALASKA
Calkins, D., and K. Pitcher. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 1. p. 371-386.

Biological effects, Offshore development, Marine mammals, Distribution, Gulf of Alaska, *Sea lions, *Ecology, *Trophic structure

Oil and gas exploration and development have the potential of greatly affecting basic productivity and the abundance of prey species of the Steller sea lions in the Gulf of Alaska. Information about population status, distribution, movement, critical habitats, growth, pathology, food habits, and trophic relationships is reported.

[from Selected Water Resources Abstracts 10(4):#W77-01837. 1977]

C-1476-77

THE DISTRIBUTION, ABUNDANCE, DIVERSITY, AND PRODUCTIVITY OF THE WESTERN BEAUFORT SEA BENTHOS
Carey, A. G., Jr. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 5. p. 219-255.

Biological effects, Offshore drilling, Oil spills, Benthos, Food web, Beaufort Sea

The extensive drilling for oil and gas on the Alaskan and Canadian North Slope has created the potential for environmental pollution. The coastal ecosystem could be adversely affected, especially in the Beaufort Sea area. The food web, if disrupted by oil spills, could cause high mortalities in top carnivores due to the lack of benthic fauna on which to feed. The effects of oil spills and petroleum activities in the Beaufort Sea are reported.

[from Selected Water Resources Abstracts 10(4):#W77-01840. 1977]

C-1477-77

SUMMARIZATION OF EXISTING LITERATURE AND UNPUBLISHED DATA ON THE DISTRIBUTION, ABUNDANCE, AND LIFE HISTORIES OF BENTHIC ORGANISMS
Carey, A. G., Jr. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 5. p. 257-712.

Biological effects, Offshore development, Benthos, Distribution, Beaufort Sea, Baseline studies

The existing literature and unpublished data on the distribution, abundance, and life histories of benthic organisms of the Beaufort Sea are summarized to determine the impact of oil and gas development on these communities. The natural variability that exists among species is estimated, and the controls that environmental conditions have on the ecosystem are investigated as they relate to petroleum development.

[from Selected Water Resources Abstracts 10(4):#W77-01841. 1977]

C-1478-77
POTENTIAL EFFECTS OF OIL PRODUCTION ON GEORGES BANK COMMUNITIES: A REVIEW OF THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR OUTER CONTINENTAL SHELF OIL AND GAS LEASE SALE NO. 42
Connor, M. S., and R. W. Howarth. 1977.
Technical report, WHOI-77-1, NOAA-77011901. 52 p.

Offshore production, EIS, OCS, Atlantic Ocean, Biological effects, *Georges Bank

In reviewing the biological section of the draft environmental impact statement for OCS lease sale No. 42, it has been found to insufficiently address several topics, in particular the sub-lethal changes in community structure and function, the accumulation and persistence of oil, and recovery times.

[from Government Reports Announcements 77(9):#PB-264074/6GA. 1977]

C-1479-77
ZOOPLANKTON AND MICRONEKTON STUDIES IN THE BERING-CHUKCHI/BEAUFORT SEAS
Cooney, R. T. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigator's Reports for the Year Ending March 1976. Vol. 7. p. 95-161.

Zooplankton, *Micronekton, Distribution, Offshore development, Bering Sea, Beaufort Sea, Baseline studies

Field studies are presented which report the distribution, abundance, and species composition of zooplankton and micronekton communities of the title areas. The report is a part of baseline studies to assess the environmental impact of Alaskan OCS petroleum development.

[from Selected Water Resources Abstracts 10(4):#W77-01850. 1977]

C-1480-77
INITIAL ZOOPLANKTON INVESTIGATIONS
Damkaer, D. M. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 7. p. 31-56.

Zooplankton, Monitoring, Distribution, Offshore development, Biological effects, Gulf of Alaska, Baseline studies

Zooplankton were sampled in the northern Gulf of Alaska as part of a baseline study of zooplankton diversity, abundance and distribution prior to petroleum resources development.

About 100 species were identified; one abundant group of species spends the day in deep water and rises to the surface layer at night. Petroleum pollutants introduced into surface layers would quickly be transferred to deeper water by these active migrations.

[from Selected Water Resources Abstracts 10(4):#W77-01848. 1977]

C-1481-77

PLANKTON OF THE GULF OF ALASKA - ICHTHYOPLANKTON
English, T. S. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 7. p. 1-30.

Monitoring, Distribution, Plankton, *Ichthyoplankton, Offshore development, Biological effects, Gulf of Alaska, Baseline studies

Baseline data on the distribution and environmental requirements of principal species of ichthyoplankton of the Gulf of Alaska were collected during various survey cruises and are summarized in this report. These data should provide a frame of reference for determining the effects of Alaskan OCS oil-gas development on the marine biota.

[from Selected Water Resources Abstracts 10(4):#W77-01847. 1977]

C-1482-77

BEAUFORT SEA PLANKTON STUDIES
English, T. S., and R. A. Horner. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 7. p. 593-671.

Monitoring, Plankton, Distribution, Beaufort Sea, Bibliographies, Baseline studies

Seasonal density distributions and environmental requirements of principal types of phytoplankton, zooplankton and ichthyoplankton were determined for Beaufort Sea species. An ongoing literature review with over 600 references on zooplankton and over 100 references on phytoplankton is included. This study constitutes part of an effort to assess the possible effects of OCS oil-gas activities on marine biota of the area.

[from Selected Water Resources Abstracts 10(4):#W77-01863. 1977]

C-1483-77
MORBIDITY AND MORTALITY OF MARINE MAMMALS--BERING SEA
Fay, F. H. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 1. p. 183-246.

Marine mammals, Toxicity, Offshore development, Bering Sea, *Mortality, Baseline studies

Baseline information is provided on the incidence and causes of pathological conditions in marine mammal populations of the Bering Sea that will be useful in evaluating future impacts of petroleum activities. Emphasis is placed on surveys of distribution and numbers of dead animals and on necropsy of such specimens for determination of causes of illness and death.

[from Selected Water Resources Abstracts 10(4):#W77-01830. 1977]

C-1484-77
SUMMARIZATION OF EXISTING LITERATURE AND UNPUBLISHED DATA ON THE DISTRIBUTION, ABUNDANCE AND PRODUCTIVITY OF BENTHIC ORGANISMS OF THE GULF OF ALASKA AND BERING SEA
Feder, H. M. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 7. p. 455-470.

Benthos, Distribution, *Productivity, Gulf of Alaska, Bering Sea, Offshore development, Biological effects

Existing literature, unpublished data, and archived biological samples available for analysis have been gathered to provide an historical perspective on abundance, distribution, and productivity of Gulf of Alaska and Bering Sea marine organisms. This historical perspective should help guide environmental planning of current OCS oil development projects.

[from Selected Water Resources Abstracts 10(4):#W77-01856. 1977]

C-1485-77
THE DISTRIBUTION, ABUNDANCE, DIVERSITY AND PRODUCTIVITY OF BENTHIC ORGANISMS IN THE GULF OF ALASKA
Feder, H. M., G. Mueller, and S. C. Jewett. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 7. p. 263-453.

Monitoring, Benthos, Distribution, *Productivity, Statistical Analysis, Gulf of Alaska, Offshore development, Biological effects, Baseline studies

Detailed biological baseline data on ninety five taxa were collected from 42 field stations in the northeast Gulf of Alaska. These data were statistically analyzed for evenness of species distribution, abundance, diversity, and productivity as part of an assessment of potential effects of offshore oil development.

[from Selected Water Resources Abstracts 10(4):#W77-01855. 1977]

C-1486-77
ENVIRONMENTAL ASSESSMENT OF THE BERING SEA: BENTHIC BIOLOGY
Feder, H. M., G. Mueller, S. C. Jewett, M. Hoberg, and K. Hafliner. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 5. p. 1-218.

Biological effects, Offshore production, Oil transport, Benthos, Oil spills, Bering Sea, Baseline studies

A qualitative and quantitative inventory of benthic species in the Bering Sea is presented in an attempt to assess the effects of oil exploration, production, and transportation. The effects of oil spills on subtidal benthic invertebrates are reported. It was found that infaunal benthic organisms can be used as indicator species for disturbed areas. A direct relationship between trophic structure and bottom stability has been demonstrated with a new complex of species becoming established in the substratum after an oil spill.

[from Selected Water Resources Abstracts 10(4):#W77-01839. 1977]

C-1487-77
ABUNDANCE AND SEASONAL DISTRIBUTION OF MARINE MAMMALS IN THE GULF OF ALASKA
Fiscus, C. H., and H. W. Braham. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 1. p. 121-139.

Marine mammals, Biological effects, Offshore development, Distribution, Gulf of Alaska, Baseline studies

The relative seasonal distribution and abundance of marine mammal species are reported using integrated sighting records taken aboard ships and chartered vessels, aircraft surveys, and from historical whaling records. The northern and coastal regions of the Gulf of Alaska are expected to be areas of tanker traffic and oil-gas activity; these areas also represent habitats for many marine mammals and seasonal migrants.

[from Selected Water Resources Abstracts 10(4):#W77-01827. 1977]

C-1488-77
ABUNDANCE AND SEASONAL DISTRIBUTION OF BOWHEAD WHALES AND BELUKHA
Fiscus, C. H., W. M. Marquette, and H. W. Braham. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 1. p. 159-182.

Offshore development, Distribution, Biological effects, Oil-gas leasing, Oil spills, Marine mammals, Bering Sea, Beaufort Sea, Baseline studies, *Whales

The effects of oil development on the biology and ecology of bowhead and belukha whales during seasonal migration between the Bering and Beaufort Seas must be evaluated before any oil-gas leasing can be implemented in the Beaufort Sea 'Basin.' Oil spills and other disturbances of the marine environment could drastically affect these migrating marine animals, especially in shore leads, even if pollution is kept local to lease sites.

[from Selected Water Resources Abstracts 10(4):#W77-01829. 1977]

C-1489-77

RESOURCE ASSESSMENT: ABUNDANCE AND SEASONAL DISTRIBUTION OF BOWHEAD AND BELUKHA WHALES--BERING SEA

Fiscus, C. H., and H. W. Braham. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 1. p. 141-157.

Offshore development, Biological effects, Marine mammals, Distribution, Bering Sea, *Whales, Baseline studies

Since adverse effects to Bowhead and Belukha whales could result from oil or gas related perturbations, identification of population centers, seasonal movements, and potential areas of breeding are major considerations in petroleum resource management decisions. These animals apparently winter in the Bering Sea, although no reliable data are known to exist.

[from Selected Water Resources Abstracts 10(4):#W77-01828. 1977]

C-1490-77

BASELINE CHARACTERIZATION: MARINE MAMMALS

Fiscus, C. H., and H. W. Braham. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 1. p. 57-119.

Offshore development, Biological effects, Oil-gas leasing, Marine mammals, Distribution, Bering Sea, Baseline studies

The identification, geographic distribution, and abundance of all marine mammals inhabiting the Bering Sea are reported. Times of migration, migration routes, and feeding grounds must be identified before decisions are made with regard to oil-gas leasing and petroleum resource development. Some pinniped species feed pelagically while others feed nearshore; many use the sea ice during spring and summer breeding seasons.

[from Selected Water Resources Abstracts 10(4):#W77-01826. 1977]

C-1491-77
BENTHOS-SEDIMENTARY SUBSTRATE INTERACTIONS
Hoskin, C. M. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 13. p. 25-305.

Benthos, Sediments, Monitoring, OCS, Environmental effects, Offshore development, Alaska, Baseline studies

Grain size characteristics of bottom sediment were related to the distribution and abundance of benthos living in and on the sedimentary substrate. Because there are interactions between benthos and sediment, baseline data are needed to evaluate changes in the substrate that could result from exploitation of offshore oil and gas resources and to determine the impact on benthic organisms.

[from Selected Water Resources Abstracts 10(7):#W77-03263. 1977]

C-1492-77
OUTER CONTINENTAL SHELF ASSESSMENT PROJECT. HERRING SPAWNING SURVEY--SOUTHERN BERING SEA
Jackson, P. B., and I. M. Warner. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 6. p. 1-16.

Biological effects, Offshore development, OCS, Fish, Fisheries, Habitat, Bering Sea, Baseline studies, *Pacific herring

The spawning ground utilization by the Pacific herring and capelin in the Bering Sea was investigated to determine the effects that offshore development may have on the habitats of these fish. The socio-economic effects of the herring fishery on local residents were determined and foreign fishing harvest levels were investigated.

[from Selected Water Resources Abstracts 10(4):#W77-01842. 1977]

C-1493-77
PETROLEUM, TEMPERATURE, AND TOXICANTS: EXAMPLES OF SUSPECTED RESPONSES BY PLANKTON AND BENTHOS ON THE CONTINENTAL SHELF
Jeffries, H. P., and W. C. Johnson, II. 1976.
Marine Reprint 69. SG-04p6-158-44002. 16p.

Offshore development, Plankton, Benthos, OCS, Ecosystems, Environmental effects

Population changes over time in natural marine communities of the New York and Mid-Atlantic Bights are enumerated. The direct effect of energy-related activities on coppod populations is not a concern at present and short-term effects are seen only at point sources. Persistent, small-scale environmental changes may have cumulative effects on benthic communities where ecosystem processes enhance, rather than dissipate these changes.

[from Selected Water Resources Abstracts 10(10):#W77-04844. 1977]

C-1494-77
PHYTOPLANKTON AND PRIMARY PRODUCTIVITY IN THE NORTHEAST GULF OF ALASKA
Larrance, J. D. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 7. p. 57-93.

Monitoring, Phytoplankton, Biological effects, Offshore development, Baseline studies, *Primary production

Phytoplankton baseline data were collected to determine their abundance, primary production rates and the environmental factors controlling production. Repopulation of phytoplankton following contamination may result in a species composition much different from the previous one. Productivity levels may also differ significantly.

[from Selected Water Resources Abstracts 10(4):#W77-01849. 1977]

C-1495-77

TROPHIC RELATIONSHIPS AMONG ICE INHABITING PHOCID SEALS
Lowry, L. F., and J. J. Burns. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 1. p. 303-332.

Biological effects, Offshore development, Marine mammals, OCS, Distribution, Bering Sea, Beaufort Sea, *Seals, *Trophic structure

The trophic structure of the ecosystems of ice inhabiting seals is evaluated in terms of potential impacts of outer continental shelf petroleum development in the Bering, Chukchi, and Beaufort Seas. Determination of the diet, foraging times, distribution, abundance, and natural history of each species will lead to a better understanding of the effects of offshore development.

[from Selected Water Resources Abstracts 10(4):#W77-01834. 1977]

C-1496-77

ENVIRONMENTAL ASPECTS OF OFFSHORE DISPOSAL OF DRILLING FLUIDS AND CUTTINGS
McAuliffe, C. D., and L. L. Palmer. 1976.
Society of Petroleum Engineers of AIME, SPE 5864. 16 p.
Society of Petroleum Engineers of AIME, 46th Annual California Regional Meeting.

Offshore drilling, Disposal, *Drilling wastes, Environmental effects, Marine organisms

Laboratory studies using various organisms show these materials generally to be relatively nontoxic. Rapid dispersion and dilution during discharge of drilling fluids and cuttings in seawater explain the lack of long-term effects in areas with 20 to 40 years of petroleum operations. Offshore discharge is an environmentally acceptable method for dispersal of drilling wastes.

[from Oceanic Abstracts 14(2):#77-01741. 1977]

C-1497-77
INCIDENCE OF PATHOLOGY OF MARINE FISH DISEASES IN THE GULF OF ALASKA, BERING SEA, AND BEAUFORT SEA
McCain, B. B., and S. R. Wellings. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 10. p. 381-433.

Monitoring, Fish, Environmental effects, Offshore development, OCS, Gulf of Alaska, Bering Sea, Beaufort Sea, Baseline studies, *Fish diseases

Baseline data have been obtained on the present health status of demersal fishes in the waters near the Alaska OCS so that future environmental effects of oil exploration and development can be evaluated. The principal criterion of fish health used is the frequency of externally visible pathological conditions. Histopathological and microbiological properties of each major disease are also being characterized.

[from Selected Water Resources Abstracts 10(7):#W77-03226. 1977]

C-1498-77
BASELINE STUDIES OF DEMERSAL RESOURCES OF THE EASTERN BERING SEA SHELF AND SLOPE
Pereyra, W. T., J. E. Reeves, and R. G. Bakkala. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 7. p. 219-242.

Monitoring, Distribution, Marine organisms, Offshore development, Biological effects, Bering Sea, Baseline studies

Results are presented of extensive sampling and biological baseline data surveys of demersal resources of the eastern Bering Sea. Distributions, abundance, life history, population characteristics, and historical exploitation patterns for commercially important species of fish, crustaceans, mollusks, and other organisms were analyzed in preparation for assessing the effects of offshore oil development.

[from Selected Water Resources Abstracts 10(4):#W77-01853. 1977]

C-1499-77

BASELINE STUDIES OF DEMERSAL RESOURCES OF THE NORTHERN GULF OF ALASKA SHELF AND SLOPE: AN HISTORICAL PREVIEW

Pereyra, W. T., L. Ronholt, and S. Hughes. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 7. p. 211-217.

Fisheries, Fish, *Shellfish, Offshore development, Biological effects, Gulf of Alaska, Baseline studies, *Demersal resources

The historic and present development of demersal fish and shellfish resources of the Gulf of Alaska is reviewed. Data on species of importance to man have been collected and analyzed so that they may be compared with earlier surveys and provide baseline data for studies on possible effects of oil development on these resources.

[from Selected Water Resources Abstracts 10(4):#W77-01852. 1977]

C-1500-77

BIOLOGY OF THE HARBOR SEAL, *PHOCA VITULINA* RICHARDI, IN THE GULF OF ALASKA

Pitcher, K., and D. Calkins. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 1. p. 247-261.

Biological effects, Offshore development, Marine mammals, Contaminants, Food web, Gulf of Alaska, *Ecology, *Harbor seal

A number of potential adverse effects of oil and gas development on harbor seal populations are reported: direct injury through contact with oil, disturbance during pupping, exposure to environmental contaminants, reduced food web productivity, and direct mortality of prey species. The ecology of the harbor seal is discussed with reference to trophic level, population, growth, seasonal distribution, sex and age segregation, and critical habitats.

[from Selected Water Resources Abstracts 10(4):#W77-01831. 1977]

C-1501-77

ASSESSMENT OF THE DISTRIBUTION AND ABUNDANCE OF SEA OTTERS ALONG THE KENAI PENINSULA, KAMISHAK BAY AND THE KODIAK ARCHIPELAGO
Schneider, K. B. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigator's Reports for the Year Ending March 1976. Vol. 1. p. 333-358.

Marine mammals, Biological effects, Offshore development, Distribution, OCS, Alaska, *Sea otters, Baseline studies

The potential adverse impact of outer continental shelf activities on sea otters appears high, as they are more vulnerable to direct oiling than other species of marine mammals and they may be indirectly affected by chronic low levels of pollution through the food chain. Information was gathered to trace the patterns of range expansion, identify those areas where OCS activities would have the greatest impact, and provide a basis for evaluating the sea otter's role in changes in marine ecosystems.

[from Selected Water Resources Abstracts 10(4):#W77-01835. 1977]

C-1502-77

DISTRIBUTION AND ABUNDANCE OF SEA OTTERS IN SOUTHWESTERN BRISTOL BAY
Schneider, K. B. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 1. p. 359-369.

Marine mammals, Distribution, Contamination, Habitat, Offshore development, Alaska, *Sea otters

Because sea otters are vulnerable to the direct effects of oiling and may be affected through the food chain by chronic low levels of pollution, the proposed outer continental shelf lease areas of Unimak Island and the Alaska Peninsula are possible sources of sea otter habitat disruption. A systematic survey of the range of population to determine sea otter distribution and number is reported.

[from Selected Water Resources Abstracts 10(4):#W77-01836. 1977]

C-1503-77

FOOD AND FEEDING RELATIONSHIPS IN THE BENTHIC AND DEMERSAL FISHES OF THE GULF OF ALASKA AND BERING SEA
Smith, R. L., A. C. Paulson, and J. R. Rose. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 7. p. 471-508.

Fish, Food web, Biological effects, Offshore development, Gulf of Alaska, Bering Sea, Baseline Studies

A study in progress is reported in which the effects of offshore oil activities on fishes can be assessed and predicted. The objectives are to construct a detailed picture of the food and feeding relationships among fishes in the Gulf of Alaska and the Bering Sea so that possible adverse interactions with OCS oil-related activities can be avoided or mimimized.

[from Selected Water Resources Abstracts 10(4):#W77-01857. 1977]

C-1504-77

ACUTE TOXICITY OF WELL-DRILLING MUDS TO RAINBOW TROUT *SALMO GAIRDNERI* (RICHARDSON)
Weir, R. H., and B. Moore. 1975.
Environmental Aspects of Chemical Use in Well-Drilling Operations, Houston, 1975. p. 113-123.

Drilling, Oil wells, Toxicity, Acute effects, Fish, Arctic, *Trout, *Drilling muds

The acute toxicity to trout of drilling muds from a Canadian Arctic exploratory oil well was due to high levels of KCl in drilling muds at surface levels of the well, and a combination of drilling components at lower well levels.

[from Chemical Abstracts 86(15):#101601c. 1977]

C-1505-77

BASELINE CHARACTERIZATION, LITTORAL BIOTA, GULF OF ALASKA AND BERING SEA
Zimmerman, S. T., and T. R. Merrell, Jr. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 6. p. 75-584.

Monitoring, Marine organisms, Distribution, Intertidal zone, Coasts, Acute effects, Chronic effects, Bering Sea, Gulf of Alaska, Baseline studies

The intertidal to subtidal biota in the region from the eastern Gulf of Alaska to the Bering Sea have been characterized and inventoried in order to determine the distribution and densities of species and biotic populations within major habitats along the coastline. Areas most likely to be impacted by floating and dissolved oil have been studied intensely. Possible acute and chronic effects of oil on the primarily non-motile biota are predicted, and possible secondary effects on marine life feeding on affected littoral populations are considered.

[from Selected Water Resources Abstracts 10(4):#W77-01846. 1977]

C-1506-77
TOXICITY AND ENVIRONMENTAL PROPERTIES OF CHEMICALS USED IN WELL-DRILLING OPERATIONS
Zitko, V. 1975.
Environmental Aspects of Chemical Use in Well-Drilling Operations, Houston, 1975. p. 311-329.

Drilling, Oil wells, Toxicity, Environmental effects, Fish, *Salmon, *Drilling muds

The acute toxicities of several organic oil well drilling mud components to juvenile Atlantic salmon were tested. Benzoic acid, benzene derivatives, naphthalene, substituted imidazolines and Na petroleum sulfonates were tested and found to have less pronounced environmental effects than the physical action of suspended solids.

[from Chemical Abstracts 86(15):#101602d. 1977]

2. SOCIAL EFFECTS

C-1507-77
ONSHORE POLICY RESEARCH AND OFFSHORE OIL: A BRITISH PERSPECTIVE
Mitchell, J. K. 1975.
The Present and Future of Coasts, Proceedings of the First Annual Conference of the Coastal Society, Arlington, Virginia, 1975. p. 241-246.

Offshore drilling, Onshore impacts, Socio-economic effects, Production

Alternative patterns of onshore social and physical impacts of the location of offshore drilling wells, levels of production, regulatory controls, and other factors are discussed. Without adequate data on existing socioeconomic conditions in the U.S., the potential benefits of East Coast oil are apt to be outweighed by the deleterious effects on an unprepared society.

[from Selected Water Resources Abstracts 10(9):#W77-04484. 1977]

3. ECONOMIC EFFECTS

C-1508-77
EXPLOITATION OF THE SEA (in French)
Didou, H. 1976.
Aménagement No. 40: 20-23.

Offshore development, Economic effects, Contamination, Fisheries, France

The views and fears of Breton fishermen are expressed with respect to oil prospecting, extraction of sands, development of naval ship repair yards, and cement works. The serious economic risks to fishing and mariculture by marine pollution (urban, industrial, agricultural, and maritime sources) are emphasized.

[from Aquatic Sciences & Fisheries Abstracts 7(3):#7Q3176. 1977]

4. GENERAL EFFECTS

C-1509-77
ECOLOGICAL PROBLEMS IN THE DEVELOPMENT OF THE PETROLEUM AND PETROCHEMICAL INDUSTRY [in Russian]
Alkhazov, T. G. 1976.
Izvestiya Vysshikh Uchebnykh Zavedenii, Neft i Gaz 19(3): 82-85

Oil industry, Development, Refineries, Petrochemicals, Environmental effects

"A review with no references."

[from Chemical Abstracts 86(10):#59703k. 1977]

C-1510-77
CALIFORNIA CLAIMS PRESENT OCS PROGRAM "CRUDE" (news brief)
Anon. 1977.
Offshore 38(5):275-276

OCS, Oil-gas leasing, Offshore development, Onshore impacts, Pollution control, California

Governor Brown's Office of Planning & Research is critical of federal offshore oil-gas leasing strategy because California must live within the onshore economic, social and environmental consequences of that development. The report calls for better oil spill control techniques and pollution control compliance inspection, better contingency planning on community levels, and streamlined spill liability assessment and damage compensation. The report urges the identification and protection of marine fisheries, recreational resources, and marine mammal breeding grounds.

C-1511-77
ENVIRONMENTAL CONSIDERATIONS OF SELECTED ENERGY CONSERVATION MANUFACTURING PROCESS OPTIONS. VOLUME 1. INDUSTRY SUMMARY REPORT
Anon. 1976.
EPA/600/7-76/034a, Contract EPA-68-03-2198.

Industries, *Energy conservation, Environmental effects, Refineries, *Technology innovation

This report assesses the likelihood of new process technology and practices being introduced by energy intensive industries and considers the environmental impacts of such changes. It covers 13 industries including the petroleum refining industry.

[from Government Reports Announcements 77(9):#PB-262 977/2GA. 1977]

C-1512-77
ENVIRONMENTAL IMPACT STATEMENT DEEPWATER PORT REGULATIONS
Anon. 1975.
Final report, U.S. Coast Guard. 241 p.

Ports, Regulations, Environmental effects, Oil discharges, Safety, EIS, *Deepwater port

The regulations will result in increased safety and a reduction in oil discharges at deepwater ports. Adverse environmental effects include slightly increased construction, operation, and maintenance costs for deepwater ports and the requirement for a vessel traffic separation scheme to prevent alternative uses of that area of the ocean. The regulations will not eliminate oil spills, regulate pipelines, control secondary development, nor set design standards for tankers. Alternatives to the regulations are discussed.

[from MRIS Abstracts 14:#14 135389. 1976]

C-1513-77

MARINE ENVIRONMENTALISTS BASCOM AND GOODWIN COMMENT ON TECHNOLOGY'S IMPACT ON OFFSHORE ECOLOGY

Anon. 1977.

Journal of Petroleum Technology, April:373-377.

Offshore drilling, Offshore development, Platforms, Environmental effects, Regulations, Oil industry

An informal dialogue is presented in which two marine environmentalists separately respond to questions about how offshore resource development, especially oil-gas development, affects marine ecology. Environmental regulations, chronic oil pollution from offshore production, and marine life on and around offshore platforms are briefly discussed.

C-1514-77

PROPOSED 1975 OUTER CONTINENTAL SHELF OIL AND GAS GENERAL LEASE SALE, OFFSHORE SOUTHERN CALIFORNIA: OCS SALE NO. 35. VOL 1-3

Bankland, C. 1975.

Draft environmental statement, Report NP-20499/P1. 2035 p.

Environmental effects, OCS, Oil-gas leasing, California coast, EIS, Offshore development

Volume 1 (807 p.) of this 3-volume draft environmental impact statement consists of descriptions of the proposal and the environment, including geology, climate, oceanography, marine organisms and habitats, environmental problems, and historical and projected economic growth. Volume 2 (510 p.) discusses the environmental impact of the proposal, mitigating factors, unavoidable adverse environmental effects, the merits of short-term use vs. long-term productivity, irreversible commitment of resources, and alternatives to the proposed action. Volume 3 (718 p.) contains the 23 appendices for the Draft environmental impact statement.

[from Petroleum Abstracts 17(12):#231,631-231,633. 1977]

C-1515-77

NATURE OF POTENTIAL OIL INDUSTRY OPERATIONS ON THE ATLANTIC CONTINENTAL SHELF

Bell, E. O. 1976.

Effects of Energy-Related Activites on the Atlantic Continental Shelf, Upton, N.Y., 1975. p. 12-30. Proceedings.

Offshore development, Oil industry, Oil wells, OCS, Environmental effects, Atlantic Coast

Offshore oil industry activities from the first seismic survey through the exploratory drilling, development, and production stage are reviewed. With some 20,000 offshore oil and gas wells across the U.S., no incident that has resulted in permanent damage to the environment has occurred. The oil industry has the technical skills and the organization to protect the environment and meet the future needs of the people.

[from Selected Water Resource Abstracts 10(10):#W77-04936. 1977]

C-1516-77

POTENTIAL ENVIRONMENTAL CONSEQUENCES OF TERTIARY OIL RECOVERY

Braxton, C., R. Stephens, C. Muller, J. White, and J. Post. 1976.

Final report, Contract EPA-68-01-1912. 229 p.

Production, Environmental effects, *Tertiary oil recovery methods, Groundwater, Water quality, Models

Potential environmental problems which are associated with a variety of enhanced oil recovery methods are described. Possible impacts on groundwater and water quality are assessed using dispersion modeling and risk estimates. Additional research needs are identified.

[from Government Reports Announcements 77(4):#PB-260 646/5GA. 1977]

C-1517-77
THE PRESENT AND FUTURE OF COASTS
Coastal Society. 1975.
Proceedings of the First Annual Conference of the Coastal Society, Arlington, Va., 1975. 287 p.

Offshore development, Coasts, Environmental effects, Resource management, *Conferences, *Coastal impacts

The problem of offshore oil development is discussed by members of Congress, oil industry, and ecological conservation organizations. The conference looked at planning, resource development, environmental impact, and the ways in which man and the coastal zone interact in an effort to obtain and maintain environmental quality along the shore.

[from Selected Water Resources Abstracts 10(9):#W77-04462. 1977]

C-1518-77
OUTER CONTINENTAL SHELF ENVIRONMENTAL STUDIES PROGRAM. SUMMARY RECOMMENDATIONS OF THE TRACE METAL AND HYDROCARBON SEMINARS SPONSORED BY THE BUREAU OF LAND MANAGEMENT, WASHINGTON, D.C., SEPTEMBER 8-12, 1975
Department of Interior, Bureau of Land Management, Marine Minerals Division. 1975.
Aerospace Report No. ATR-76(7504)-5. Section 2 (Hydrocarbon Seminar). 28 p.

Offshore development, OCS, BLM, Environmental effects, Hydrocarbons, *Trace metals

Summary not available.

[from On Effects of Oil Pollution in Arctic and Subarctic Waters. Seattle, Northwest Marine Fisheries Center. September, 1976]

C-1519-77
PROCEEDINGS OF THE SYMPOSIUM ON OFFSHORE OIL POTENTIAL AND RELATED LAND USE IMPACT IN THE CENTRAL CALIFORNIA COASTAL ZONE
Doyle, W. T. (ed.). 1975.
University of California (Santa Cruz), Coastal Marine Studies Special Publication No. 3. iii + 81 p.

Offshore development, California coast, Onshore impacts, Legislation

The transcript of several presentations are given. Topics covered include the geologic setting of the Central

California Coastal Zone (CCCZ); estimates of CCCZ potential offshore oil resources; a review of offshore extraction and onshore facilities; a discussion of potential CCCZ land and resource use conflicts resulting from offshore development; and legal issues of offshore and coastal development.

C-1520-77
YUKON DELTA COASTAL PROCESSES STUDY
Dupre, W. R., and D. M. Hopkins. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 13. p. 5-40.

Offshore development, Environmental effects, Oil spills, OCS, Alaska, *Geology, *Hydrology, *Yukon delta

The Quaternary faults and volcanoes which characterize much of the Yukon delta constitute serious geological constraints on the selection of transportation corridors. The siting of offshore petroleum facilities must take into account the extent of shorefast ice, the possibility of offshore permafrost, and the possible effects of altering offshore bathymetry in changing coastal stability. In addition, the effects of possible oil spills must take into account the northward drift of water and sediments and the local and seasonal variability of current patterns.

[from Selected Water Resources Abstracts 10(7):#W77-03255. 1977]

C-1521-77
AN ENVIRONMENTAL OVERVIEW OF UNITED STATES ENERGY FUTURES
Gage, S. J. 1976.
EPA Report 600/7-76-002. p. 15-25.

Offshore production, Environmental effects, U.S., Oil shale, Development

"A general discussion and prediction of the environmental impacts of energy production in the United States. Briefly treated are the impacts of petroleum production in the marine environment, coal mining, especially surface mining, coal utilization, including fluidized bed combustion, oil shale development, geothermal energy development and solar energy."

[from Selected Water Resources Abstracts 10(6):#W77-02650. 1977]

C-1522-77
IMPACTS OF OUTER CONTINENTAL SHELF ACTIVITIES: LAFOURCHE PARISH, LA.
Happ, G., V. R. Bennett, W. Burke, III, W. H. Conner, and N. J. Craig. 1976.
Final report, NOAA-76121310. 154 p.

Offshore development, OCS, Environmental effects, Oil spills, Pipelines, Marshes, Louisiana, *Lafourche Parish

The major environmental impacts of OCS activities are: OCS employment-derived population increases, OCS use of pipeline ditches and navigational canals, and potential oil spills. OCS-use of oil and gas pipeline canals, and dredging of landfill, muck disposal, and spoil banks are other sources of environmental impact upon Lafourche Parish.

[from Government Reports Announcements 77(8):#PB-263 412/9GA. 1977]

C-1523-77
RESULTS OF AN ENVIRONMENTAL RESEARCH PROGRAM IN THE CANADIAN BEAUFORT SEA
Hnatiuk, J. 1977.
Journal of Petroleum Technology, June:604-612.

Offshore drilling, Spill cleanup, Ice, Baseline studies, Marine organisms, Environmental effects, Arctic, Beaufort Sea

The general results are presented of a comprehensive environmental research program consisting of 33 wildlife, biological, oceanographic, meteorological, sea ice, and oil cleanup studies in the Beaufort Sea. The studies, conducted from 1974 to 1976, are providing the following: ecological baseline data, a better understanding of the physical environment, knowledge of possible consequences of oil spillage, and means for oil cleanup under arctic conditions. The results of this joint government-industry program have been used to set operating constraints for safeguarding the environment.

C-1524-77
IN THE WAKE OF ARGO MERCHANT (news brief)
Howard, D. V. 1977.
Massachusetts Audubon 16(6):6-7.

Oil-gas leasing, Atlantic Ocean, EIS, Environmental effects, Fisheries, Argo Merchant spill, BLM, *Georges Bank

The U.S. Bureau of Land Management hearing on the environmental impact statement for the Georges Bank lease sale is reported in light of the Argo Merchant oil spill. The effects of offshore oil development on New England fisheries and tourism are discussed.

C-1525-77
Oil Comes to the Shetlands
Koenig, P. 1977.
Audubon 79(2):129-133

Socio-economic effects, Oil industry, Environmental effects, Production, Scotland, *Sullom Voe

The natural history and socio-economic development of the Shetland Islands are described. Oil interest and production in Sullom Voe are discussed and the possible environmental effects of this production are presented. Accounts of interviews of local citizens around Sullom Voe are given.

C-1526-77
ENVIRONMENTAL ASPECTS OF PRODUCED WATERS FROM OIL AND GAS EXTRACTION OPERATIONS IN OFFSHORE AND COASTAL WATERS
Koons, C. B., C. D. McAuliffe, and F. T. Weiss. 1977.
Journal of Petroleum Technology June:723-729.

Offshore production, Extraction, Fate, Hydrocarbons, Environmental effects, Coasts, *Produced waters

This paper reviews a number of laboratory and field studies on produced waters and their effects on offshore and coastal marine environments. The report was prepared in order to allay some of the concerns about the fate and possible detrimental effects of the continued discharge of hydrocarbons and other organic and inorganic constituents of produced waters.

C-1527-77
DRAFT ENVIRONMENTAL IMPACT STATEMENT. PARAHO FULL SIZE MODULE OIL SHALE RETORT FACILITY
Laramie Energy Research Center. 1977.
ERDA, unnumbered report. 340 p.

Oil shale, Production, EIS, Solid wastes, Disposal, Restoration, Colorado

An environmental impact statement (EIS) has been prepared by ERDA for the proposed U.S. Navy-sponsored Paraho oil shale research project at Anvil Points, Colorado. For this project, at least four million tons of oil shale will be retorted, and about two million barrels of oil will be extracted. The EIS covers the disposal of some 3.6 million tons of spent oil shales in Paraho Canyon and restoration of the disposal site by compacting, contouring and revegetating.

[from Petroleum Abstracts 17(15):#232, 326. 1977]

C-1528-77
OTC HIGHLIGHTS HYDROCARBON SAFETY
LeBlanc, L. 1977.
Offshore 38(5):179-181.

Offshore production, Safety, Environmental protection, Pollution prevention, Economics

Producing hydrocarbons under the world's oceans at a cost near that of land production and doing it safely both for man and the environment are the two major topics addressed in the 10th Annual Offshore Technology Conference held in Houston, May 2-5, 1977. Over 300 papers are presented, among which are papers on environmental and pollution considerations, geologic hazards, spill detection, blowout prevention, and environmental and biological effects of offshore production.

C-1529-77
OIL: STUDY OF POLLUTION INSURANCE LIABILITY LAWS
Lipeles, M. 1975.
Environmental Policy Institute research paper. 69 p.

Regulations, Liability, Insurance, Ships, Ports, Offshore development

The paper describes and evaluates existing liability schemes affecting vessels, deepwater ports, and onshore and offshore facilities. Particular attention is given to insurance arrangements that cover such liabilities. A discussion of the central issues culminates in a comparative analysis of the two key proposals pending before Congress.

[from MRIS Abstracts 14:#14 135863. 1976]

C-1530-77
ENVIRONMENTAL AND ONSHORE IMPACT OF OFFSHORE DRILLING
Menard, et al. 1975.
American Enterprise Institute National Energy Project Conference, Beverly Hills, 1975. p. 33-65.

Onshore impacts, Offshore drilling, Environmental effects

The seriousness of environmental damage from offshore drilling is discussed and the value of oceanic baseline studies is disputed. The author feels that the main onshore effects would occur as a result of the need for supporting equipment and facilities, and that environmental impacts should not be measured in absolute terms but according to the actual exposure of people to environmental "insults".

[from Environment Abstracts 7(1):#77-00339. 1977]

C-1531-77
OFFSHORE DRILLING FOR OIL IN THE BEAUFORT SEA: A PRELIMINARY ENVIRONMENTAL ASSESSMENT
Milne, A. R., and B. D. Smiley. 1976.
Canada Department of the Environment, Beaufort Sea Project technical report, No. 39. 43 p.

Offshore drilling, Oil spills, Spreading, Movement, Environmental effects, Marine mammals, Birds, Fish, Beaufort Sea

The report assesses the possibility and effects of an oil well blowout in the Beaufort Sea. Using a hypothetical blowout scenario from three possible drill sites, the report analyzes the effects of water currents, climate, weather and ice formation on the spreading, movement and general fate of oil during different seasons. The impact of large spills on climatic patterns, seabirds, marine mammals and fish are considered, especially those biological resources considered valuable to man.

C-1532-77
ENVIRONMENTAL EFFECT OF FOSSIL FUELS
Morris, S. C. 1975.
Georgia Institute of Technology Conference on Energy/Environment Cost Benefit Analysis, Atlanta, 1975. p. 318-329.

Fossil fuels, Environmental effects, Water quality, Oil spills

Climatic, air, water, and land effects of fossil fuel systems are assessed. Major vectors affecting water originate with coal mine drainage, oil spills, and power plant cooling.

[from Energy Information Abstracts 2(1):#77-20736. 1977]

C-1533-77
ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF.
VOLUME 1. PRINCIPAL INVESTIGATORS' REPORTS APRIL-JUNE 1976.
National Oceanic and Atmospheric Administration, Environmental Research Labs. 1976.
NOAA-76122707; NTIS PB-263 064/8GA. 951 p.

Offshore development, Environmental effects, OCS, Baseline studies, Marine organisms, Birds, Alaska

"This volume contains the quarterly reports of baseline studies on the environmental effects of the development of resources on the Alaska continental shelf. Baseline studies encompass the marine mammals, birds, fish, plankton, benthos and littoral biota."

[from Selected Water Resources Abstracts 10(9):#W77-04200. 1977]

C-1534-77
ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF.
VOLUME 2. PRINCIPAL INVESTIGATORS' REPORTS APRIL-JUNE 1976.
National Oceanic and Atmospheric Administration, Environmental Research Labs. 1976.
NOAA-77122708; NTIS PB-263 065/5GA. 873 p.

Offshore development, Environmental effects, OCS, Baseline studies, Alaska

"This volume contains the quarterly reports of baseline studies on the environmental effects of the development of resources on the Alaska continental shelf. Baseline studies encompass pollution effects, chemistry and microbiology, physical oceanography, geology, ice and data management."

[from Selected Water Resources Abstracts 10(9):#W77-04201. 1977]

C-1535-77
COASTAL EFFECTS OF OFFSHORE ENERGY SYSTEMS: AN ASSESSMENT OF OIL AND GAS SYSTEMS, DEEP WATER PORTS, AND NUCLEAR POWER PLANTS OFF THE COAST OF NEW JERSEY AND DELAWARE
Office of Technology Assessment. 1976.
Stock No. 052-003-00245-1. 304 p.

Offshore development, Onshore impacts, Ports, Socio-economic effects, Coasts, New Jersey, Delaware

Presented is the Office of Technology Assessment's analysis of probable onshore impacts of three technologies studied off the coast of New Jersey and Delaware. The study specifically delineates the possible actions Congress may want to consider in future legislation dealing with offshore oil and gas and deep water ports. Possible economic, political, social, and legal impacts of implementing the technologies are discussed.

C-1536-77
POTENTIAL LAND USE CONFLICTS RESULTING FROM OFFSHORE DRILLING IN THE CENTRAL CALIFORNIA COASTAL AREA
Pepper, J. E. 1975.
Proceedings of the Symposium on Offshore Oil Potential and Related Land Use Impacts in the Central California Coastal Zone. W. T. Doyle (ed.). p. 51-66. (University of California, Santa Cruz , Coastal Marine Studies Special Publication No. 3)

Offshore drilling, Onshore impacts, Pollution prevention, California coast, *Land use conflicts

Potential adverse impacts of offshore development on Central California's coastal and land resources, and means for avoiding resource-use conflicts are explored. Parts of the California Coastal Zone Conservation Commission Preliminary Plan are discussed. Set forth are policies for controlling or preventing oil discharges and spills and regulating offshore and onshore oil-related facilities in scenic, environmentally significant, or otherwise incompatible areas.

C-1537-77
OIL SHALE: THE PROSPECTS AND PROBLEMS OF AN EMERGING ENERGY INDUSTRY
Rattien, S., and D. Eaton. 1976.
Annual Review of Energy 1:183-212.

Oil shale, Development, Production, Economics, Environmental effects

Technological, economic, environmental and institutional aspects of commercial oil shale development are examined. Although a commercial shale oil industry appears feasible from a resource and technology perspective, there remain significant uncertainties about the economics, availability of water supply, and environmental effects of such development.

[from Energy Abstracts for Policy Analysis 2(11):#2113. 1976]

C-1538-77
BER BALANCED PROGRAM PLAN: OIL SHALE TECHNOLOGY
Schulte, H. F., A. K. Stoker, E. E. Campbell, E. C. Anderson, and G. E. Dials. 1976.
Report LA-6390-MS, Contract W-7405-eng-36. 42 p.

Oil shale, Development, Environmental effects, *Research programs

Twenty-three biomedical and environmental research projects are described as to program title, scope, milestones, technology time frame, program unit priority, and estimated program unit cost.

[from ERDA Energy Research Abstracts 2(1):#231. 1977]

C-1539-77
AN OILSPILL RISK ANALYSIS FOR THE NORTH ATLANTIC OUTER CONTINENTAL SHELF LEASE AREA
Smith, R. A., et al. 1976.
USGS Open-File Report 76-620. 50 p.

Oil spills, Offshore development, OCS, Environmental effects, Atlantic coast, *Risk analysis

An oil spill risk analysis was conducted to determine relative environmental hazards of oil development in the North Atlantic outer continental shelf lease area. The probability of spill occurrence, likely path of pollutants from spills, and locations in space and time of vulnerable recreational and biological resources are analyzed, and the results are combined to yield estimates of the overall oil spill risk in the lease area.

[from Environment Abstract 7(1):#77-00338. 1977]

C-1540-77
HYDRODYNAMICS OF AN OIL WELL BLOWOUT
Topham, D. R. 1975.
Canada Department of the Environment, Beaufort Sea Project technical report, No. 33. 52 p.

Oil wells, *Submarine blowout simulation, Models, Containment, Fate

Shallow submarine oil well blowout situations were simulated by releasing continuous streams of air and gas/oil mixtures at depths of 23 and 60 m. In all cases, a central rising plume with radial surface flow patterns and a ring of waves concentric with the plume center were noted. The ring of waves was found to provide a certain amount of natural containment, causing the streams of emulsified oil to coalesce and be retained within the wave ring.

C-1541-77
SOCIAL AND ECONOMIC IMPACT ASSESSMENT OF ALASKA OUTER CONTINENTAL SHELF PETROLEUM DEVELOPMENT
University of Alaska. 1975.
Washington, D. C., Alaska Outer Continental Shelf Office,
Bureau of Land Management, 1975. 97 p.

Offshore development, Social effects, Economic effects, Alaska

The document relates the interrelations among the physical, economic, social, individual, and political phenomena that condition human welfare. The analysis is organized in terms of geographical entities: the State of Alaska, the several regions within which the oil and gas development will take place, and the local communities where social-cultural integration takes place.

[from ERDA Energy Research Abstracts 2(2):#3333. 1977]

C-1542-77
OUTER CONTINENTAL SHELF ENVIRONMENT ASSESSMENT PROGRAM IN THE BEAUFORT SEA
Weller, G. 1976.
Arctic Bulletin 2(9):125-142.

Biological effects, Offshore development, OCS, Habitat, Onshore impacts, Spill cleanup, Pollution prevention

An account of the title investigation is described. The major biological populations and habitats subject to possible impact by petroleum exploration and development are discussed. Necessarysupport facilities to meet production systems and onshore developments are presented. Spill prevention and cleanup operations are evaluated.

C-1543-77
OIL SHALE DEVELOPMENT
Wellman, P. 1976.
Intersociety Energy Conversion Engineering Conference, 11th, State Line, Nevada, 1976. New York, AIChE, 1976. SAE Paper 769316. Vol. 1. p.336-340.

Oil shale, Development, Economics, Environmental effects

"Policy and economic problems affecting utilization of kerogen from oil shale are discussed. Environmental constraints are analyzed and the need of long range planning and government co-sponsored development is emphasized."

[from The Engineering Index Monthly 15(3):#018658. 1977]

E. FATE OF OIL IN THE ENVIRONMENT

1. BIODEGRADATION

C-1544-77
MICROBIOLOGICAL CYCLING OF OIL IN ESTUARINE MARSHLANDS
Ahearn, D. G., S. A. Crow, and N. H. Berner. 1976.
Estuarine Processes, Uses, Stresses, and Adaptation to the Estuary. New York, Academic Press, 1976. Vol. 1. p.483-492.

Biodegradation, Crude oil, Microorganisms, Marshes, Estuaries

This report examines the effects of Louisiana crude oil and a mixed culture of yeasts on the indigenous microbial flora. The hydrocarbon-utilizing bacteria and yeasts increased at sites accidentally or experimentally inundated with crude oil. Marsh sediments contained low populations of hydrocarbonoclastic fungi with few strains showing significant oil-emulsifying properties. In culture, a mixed culture of *Candida maltosa* and *C. lipolytica* gave significant emulsification of crude oil and utilized up to 90% of selected hydrocarbons.

C-1545-77
ASSESSMENT OF POTENTIAL INTERACTIONS OF MICROORGANISMS AND POLLUTANTS RESULTING FROM PETROLEUM DEVELOPMENT ON THE OUTER CONTINENTAL SHELF IN THE BEAUFORT SEA
Atlas, R. M. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976, Vol. 9. p.1-286.

Biodegradation, Hydrocarbons, Microorganisms, Offshore development, OCS, Beaufort Sea, Baseline studies

A baseline description was established of microbial communities in the Beaufort Sea. Included is quantitative information on the occurrence of physiological groups of microorganisms, the qualitative taxonomic characteristics of dominant microorganism species, and the ability of indigenous microorganisms to transform petroleum hydrocarbons entering the ecosystem from OCS development.

[from Selected Water Resources Abstracts 10(7):#W77-03217. 1977]

C-1546-77

ASSESSMENT OF POTENTIAL INTERACTIONS OF MICROORGANISMS AND POLLUTANTS RESULTING FROM PETROLEUM DEVELOPMENT ON THE OUTER CONTINENTAL SHELF IN THE GULF OF ALASKA
Atlas, R. M. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 9. p.287-345.

Biodegradation, Hydrocarbons, Microorganisms, Offshore development, OCS, Gulf of Alaska, Baseline studies

A baseline description was established of microbial communities in the Gulf of Alaska. Included is quantitative information on the occurrence of physiological groups of microorganisms, the qualitative taxonomic characteristics of dominant microbial species, and the ability of indigenous microorganisms to transform petroleum hydrocarbons entering the ecosystem from OCS development.

[from Selected Water Resources Abstracts 10(7):#W77-03217. 1977]

C-1547-77

FATE AND EFFECTS OF OIL POLLUTANTS IN EXTREMELY COLD MARINE ENVIRONMENTS
Atlas, R. M. 1976.
Annual Report No. 4, Contract N00014-76-C-0400. 39p.

Biodegradation, Crude oil, Petroleum products, Toxicity, Crustaceans, Monitoring, Arctic, *Amphipods

Simulation of oil biodegradation in Arctic coastal marine waters indicated very slow degradation. Microbial degradation was enhanced by addition of nutrients. Low concentrations of soluble/dispersed oil resulted in sublethal changes in the movement and feeding of arctic amphipods; higher concentrations proved lethal. Microorganisms were found to be useful in monitoring hydrocarbon contamination levels.

[from Government Reports Announcements 77(5):#AD-A033 477/1GA. 1977]

C-1548-77

ISOLATION AND STUDY OF A NEW MARINE BACTERIUM GROWING ON HYDROCARBONS. II. MECHANISMS OF LYSIS AND VIABILITY [English summary]
Bertrand, J. C., H. Bazin, and E. Azoulay. 1976.
Annales De Microbiologie B127(3):393-409.

Biodegradation, Hydrocarbons, Bacteria, *Lysis, *Ionic concentration

The growth of the marine bacterium L.16.1 is dependent on the presence of a well-defined NaCl concentration in the medium and will undergo lysis on transfer from high to low ionic environments. This lytic phenomenon can be prevented by the presence of sodium or divalent cations and appears to be due to the loss of magnesium and calcium ions by the cells.

C-1549-77
ISOLATION AND STUDY OF A NEW MARINE BACTERIUM GROWING ON HYDROCARBONS. III. OXIDATION OF SUBSTRATES AND EFFECTS OF DETERGENTS ON THE CELLS [English summary]
Bertrand, J. C., H. Bazin, S. Mutaftschiev, and E. Azoulay. 1976.
Annales De Microbiologie B127(3):411-427.

Biodegradation, Hydrocarbons, Bacteria, Oxidation, Toxicity, Surfactants, *Ionic concentration, *Detergents

The oxidation of exogenous hexadecane by cells of the bacterial strain L.16.1 is a function of intracellular and extracellular sodium and potassium ion concentrations. Cells which lost their sodium as a result of washing oxidize hexadecane at a very low rate; this indicates that sodium may play a role in the cytoplasmic membrane and in the oxidative activities of the cell membrane. Growth and respiration are inhibited by low concentrations of ionic detergents, whereas non-ionic detergents can serve as growth substrates and are oxidized like hexadecane.

C-1550-77
ISOLATION AND STUDY OF A NEW MARINE BACTERIUM GROWING ON HYDROCARBONS. I. PHYSIOLOGICAL STUDY [English summary]
Bertrand, J. C., S. Mutaftschiev, H. G. Henkel, H. Bazin, and E. Azoulay. 1976.
Annales De Microbiologie B127(3):373-391.

Biodegradation, Hydrocarbons, Bacteria, Coasts, Monitoring

The growth of a bacterial strain isolated from coastal waters which were polluted by oil-waste was monitored and found to preferentially utilize alkanes with a carbon number greater than nine. This strain is sodium dependent at the physiological level and is characterized by a high lipid content.

C-1551-77
APPARATUS AND METHOD FOR COMBATTING HYDROCARBON IMPURITIES ON THE EARTH'S SURFACE, ESPECIALLY ON WATER SURFACES
Bisa, K., and T. Bisa. 1976.
German Offenlegungsschriften (unexamined patent application) 2,506,612

Biodegradation, Oil slicks, Bacteria, Spill cleanup, Design and engineering, Patent

Bacterial biodegradation of hydrocarbons is proposed as a means of removing oil from water surfaces. An apparatus is described which disperses an aqueous suspension of bacteria and nutrients as an aerosol over the water surface and uses compressed air as a propellant gas.

[from Chemical Abstracts 86(12):#78264j. 1977]

C-1552-77
IMPACT OF THE USE OF MICROORGANISMS ON THE AQUATIC ENVIRONMENT
Bourquin, A. W., D. G. Ahearn, and S. P. Meyers. 1975.
Report EPA 660-3-75-001.

Biodegradation, Hydrocarbons, Microorganisms, *Aquatic environment

Summary not available.

[from S. P. Meyers, Louisiana State University Station, P.O. Box 19090-A, Baton Rouge, LA 70803]

C-1553-77
BIODEGRADATION OF CRUDE PETROLEUM BY THE INDIGENOUS MICROBIAL FLORA OF THE BEAUFORT SEA
Bunch, J. N., and R. C. Harland. 1976.
Canada Department of the Environment. Beaufort Sea Project Technical Report No. 10. 52p.

Biodegradation, Crude oil, Microorganisms, Sampling, Biological effects, Beaufort Sea

Microbial sampling was conducted in the South Beaufort Sea during the summer of 1974-1975, and indigenous heterotrophic flora collected were found to be predominantly psychrophilic. This report describes the sampling, laboratory procedures, and determination of the biodegradation potentials and rates, optimal temperature ranges, and nutrient requirements for different microbial cultures. Results indicate that optimal biodegradation occurred at 20°C or below and that the indigenous flora did not respond adversely to moderate inputs of petroleum.

C-1554-77
UTILIZATION OF CRUDE OIL AND MIXED HYDROCARBON SUBSTRATE BY ATLANTIC OCEAN MICROORGANISMS
Conrad, B. F., J. D. Walker, and R. R. Colwell. 1976.
Developments in Industrial Microbiology. L. A. Underkofler (ed.). Washington, D. C., American Institute Biological Sciences, 1976. Vol. 17. p.283-291. Proceedings of General Meeting of the Society for Industrial Microbiology, 32nd, 1975.

Biodegradation, Crude oil, Hydrocarbons, Microorganisms, Sampling, Atlantic Ocean

Sediment samples collected at three stations off the coast of North Carolina were examined for petroleum-degrading microorganisms.

A South Louisiana crude oil and a mixture of hydrocarbons served as substrates in the study. The mixed hydrocarbon substrate yielded larger bacterial populations than the South Louisiana crude oil. Microorganisms sampled from the deep-ocean environment (3500 m) provided significant degradation of crude oil and mixed hydrocarbon substrate, when culture conditions were optimum for growth, compared with sediment collected from the near-shore environment (8 m).

C-1555-77
PSYCHROPHILIC HYDROCARBON - DEGRADING BACTERIA FROM NARRAGANSET BAY, RHODE ISLAND
Cundell, A. M., and R. W. Traxler. 1976.
Material und Organismen 11(1):1-17.

Biodegradation, Hydrocarbons, Bacteria, Narraganset Bay, *Growth studies

Representative bacterial isolates were screened on n-hexadecane, methylcyclohexane, p-xylene, n-hexylbenzene and naphthalene to demonstrate their ability to grow at the expense of a range of hydrocarbons on solid media at 0, 8, 16, and 24°C. Growth on the hydrocarbons at all temperatures indicated that the bacteria were facultative psychrophiles. Results of growth rate studies for two hydrocarbon-degrading bacteria grown on n-dodecane and naphthalene are presented.

C-1556-77
THE RATE OF MICROBIAL DEGRADATION OF OIL IN A BEACH GRAVEL COLUMN
Gibbs, C. F., and S. J. Davis. 1976.
Microbial Ecology 3(1):55-64.

Biodegradation, Crude oil, Microorganisms, Beaches, Oxidation, *Beach gravel

The biodegradation of crude oil in coarse beach gravel was followed using an automatic continuous flow respirometer. After an initial addition of nitrate and phosphate nutrients to begin the oxidation processes, biodegradation rates gradually increased without further addition of nutrients.

[from Biological Abstracts 63(5):#26131. 1977]

C-1557-77
MICROBIAL ASPECTS OF THE DETERIORATION OF MATERIALS
Gilbert, R. J., and D. W. Lovelock (eds.). 1975.
New York, Academic Press, 1975. 261p.
(Society for Applied Bacteriology technical series no. 9).

Biodegradation, Petroleum products, Fuels, Microorganisms

Included are fourteen papers presented at the Autumn Demonstration Meeting of the Society of Applied Bacteriology, October 24, 1973, in London. Biodeterioration of petroleum products and fuels are among the topics covered.

[from The Engineering Index Monthly 15(2):#010972. 1977]

C-1558-77
HYDROCARBON UTILIZATION BY BREVIBACTERIUM, AZOTOMONAS, PROTAMINOBACTERIUM, MYCOCOCCUS AND AEROMONAS
Lonsane, B. K., K. Vadalkar, H. D. Singh, and J. N. Baruah. 1976.
Indian Journal of Experimental Biology 14(6):734-736.

Biodegradation, Hydrocarbons, Metabolism, Bacteria

"Morphological, cultural and biochemical characteristics of 7 bacterial isolates capable of utilizing hydrocarbons as sole C source, reveal that 3 isolates belong to the genus Aeromonas and 1 each to Brevibacterium, Protaminobacter, Mycocococcus, and Azotomonas. The isolates grow on gas oil and n-alkanes. The hydrocarbon-utilizing abilities of Protaminobacter, Azotomonas, and Aeromonas were not previously known."

[from Chemical Abstracts 86(9):#52541x. 1977]

C-1559-77
POLLUTION BY HYDROCARBONS AND THE FIGHT AGAINST IT [English summary]
Mardirossian, J. 1976.
Industrie du Petrole dans le Monde-Gaz-Chimie 44(474):74-75, 77,79,82.

Biodegradation, Hydrocarbons, Microorganisms, Pollution control

The biological requirements underlying microbial biodegradation of hydrocarbons in water and the acceleration of microbial oxidation by use of concentrated activated muds and thorough aeration are discussed. Sensitivity of microbes to toxic substances is described; and recent attempts to develop fast-acting and efficient petroleum-degrading microorganisms are outlined.

[from Petroleum Abstracts 17(14):#232,061. 1977]

C-1560-77
SELF-PURIFICATION IN THE COASTAL WATERS OF THE BLACK SEA [in Russian]
Mironov, O. G., L. N. Kiryukhina, M. I. Kucherenko, and E. P. Tarkhova. 1975.
Kiev, USSR, Naukova Dumka, 1975. 143p.

Biodegradation, Bacteria, Coasts, *Coastal waters, Sediments, Black Sea, USSR

The self-purification of coastal waters and bottom sediments of the Black Sea was evaluated by determining the abundance, number of species, diversity and composition, distribution, and biochemical characteristics of oil-metabolizing microorganisms. Several genera of petroleum-oxidizing bacteria were isolated in the study area and their capacity for metabolizing oil was examined.

[from Biological Abstracts 63(4):#19684. 1977]

C-1561-77
BASELINE STUDY OF MICROBIAL ACTIVITY IN THE BEAUFORT SEA AND GULF OF ALASKA AND ANALYSIS OF CRUDE OIL DEGRADATION BY PSYCHROPHILIC BACTERIA
Morita, R. Y., and R. P. Griffiths. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Year Ending March 1976. Vol. 10. p.147-191.

Biodegradation, Acute effects, Crude oil, Bacteria, Uptake, Metabolism, Beaufort Sea, Gulf of Alaska, Baseline studies

The acute effects of crude oil exposure on the uptake and respiration of glutamic acid by a natural microbial population were studied. During initial stages of incubation, the levels of activity were lower in the crude oil enrichment, but as incubation progressed, the levels of activity increased. Psychrophilic crude oil-degrading bacteria are probably quite rare in Beaufort Sea waters. Most of the crude oil-degrading bacteria are probably psychrotrophic.

[from Selected Water Resources Abstracts 10(7):#W77-03223. 1977]

C-1562-77
THE MICROBIAL DEGRADATION OF OIL IN CONTINUOUS CULTURE
Pritchard, P. H., and T. J. Starr. 1975.
Annual Report No. 2, ONR 00014-73-C-0074; NTIS AD/A-013 322.
81p.

Biodegradation, Oil spills, Bacteria, Fate, Emulsification, Dispersions, Weathering

The development and testing of a continuous culture system for the microbial degradation of oil in aquatic ecosystems are described. The fate of a mini oil spill under laboratory conditions is presented. Slow emulsification, dispersion, and chemical alteration of the oil were followed by a bacterial attack; the degradation process was not necessarily enhanced by the addition of detergents.

[from Selected Water Resources Abstracts 10(6):#W77-3012. 1977]

C-1563-77
BIODEGRADATION OF OIL BY MARINE MICROORGANISMS AT POTENTIAL OFF-SHORE DRILLING SITES
Seesman, P. A., J. D. Walker, and R. R. Colwell. 1976.
Developments in Industrial Microbiology. L. A. Underkofler (ed.).
Washington, D. C., American Institute Biological Sciences, 1976.
Vol. 17. p.293-297. Proceedings of General Meeting of the
Society for Industrial Microbiology, 32nd, 1975.

Biodegradation, Crude oil, Microorganisms, Sampling, Atlantic coast, Offshore drilling, *Oil development sites

Surface seawater samples collected at sites of potential oil exploration along the U.S. southeastern Atlantic Coast were examined for bacteria capable of degrading South Louisiana crude oil. Results suggest that oil degradation was limited by PO_4 and NH_4 concentration. Relatively little degradation of crude oil was effected by microorganisms in seawater samples collected at the sites included in the study.

C-1564-77
QUANTITATIVE ASSESSMENT OF PETROLEUM PRODUCTS IN A SURFACE LAYER [in Russian]
Semenov, A. D., L. F. Pavlenko, and A. G. Stradomskaya. 1975.
Gidrokhimicheskie Materialy 62:166-173.

Biodegradation, Oil spills, Petroleum products, Bacteria

"The surface layer contained 70-90% petroleum products. This dropped to 20-40% after 20 days. Biodegrading bacteria was larger in the spill than in the water. Aliphatic and aromatic hydrocarbon concentrations were 55-90 and 12-45%, respectively."

[from Chemical Abstracts 86(10):#60309t. 1977]

C-1565-77

MICROBIAL METABOLISM, OF ALICYCLIC HYDROCARBONS - ISOLATION AND PROPERTIES OF A CYCLOHEXANE-DEGRADING BACTERIUM

Stirling, L. A., R. J. Watkinson, and I. J. Higgins. 1977.
The Journal of General Microbiology 99(1):119-125.

Biodegradation, Hydrocarbons, Metabolism, Bacteria, Estuaries, *Cyclohexane degradation

A bacterium which grows on cyclohexane as a sole carbon and energy source has been isolated from estuarine mud flats. The organism is auxotrophic for biotin and grows on cyclohexane with a mean generation time of 10 hours and a γ_{sub} of 59.9 g dry wt (mol cyclohexane)$^{-1}$. Growth, respiration, and enzyme studies are consistent with the degradation of cyclohexane via cyclohexanol, cyclohexanone, ε-caprolactone and 6-hydroxycaproate.

C-1566-77

BACTERIONEUSTON AND PROBLEM OF DEGRADATION IN SURFACE FILMS OF ORGANIC SUBSTANCES RELEASED INTO THE SEA

Tsiban, A. V. 1976.
Seventh International Conference on Water Pollution Research. Technical papers. S. H. Jenkins (ed.). Oxford, Pergamon Press, 1976. p.793-799.

Biodegradation, Oil slicks, Bacteria, Neuston, Black Sea, Caspian Sea, Gulf of Alaska, *Azov Sea

Bacterioneuston degradation of natural and artificial organic oil films is described and investigations conducted in the Black, Caspian, and Azov Seas, and in the Alaskan Gulf are presented. Water samples and bacteria were isolated and studied.

[from ERDA Energy Research Abstracts 2(6):#14864. 1977]

C-1567-77

DEGRADATION OF HYDROCARBONS AND MIXED HYDROCARBON SUBSTRATE BY MICROORGANISMS FROM CHESAPEAKE BAY

Walker, J. D., and R. R. Colwell. 1976.
Seventh International Conference on Water Pollution Research. Technical papers. S. H. Jenkins (ed.). Oxford, Pergamon Press, 1976. p.783-791.

Biodegradation, Aromatic hydrocarbons, Microorganisms, Bacteria, Sediments, Chesapeake Bay

Microorganisms isolated from Colgate Creek in Baltimore Harbor of Chesapeake Bay were capable of degrading paraffinic, mono-, and dicyclic aromatic hydrocarbons of the type occurring in sediment from that area. Higher numbers of petroleum-degrading bacteria were found in Poole's Island samples; these bacteria may be responsible for the oil content reduction.

[from ERDA Energy Research Abstracts 2(6):#14933. 1977]

C-1568-77
MICROBIAL DEGRADATION OF EMPIRE MIX CRUDE OIL
Wyman, J. F., and L. R. Brown. 1976.
Developments in Industrial Microbiology. L. A. Underkofler (ed.).
Washington, D. C., American Institute Biological Sciences, 1976.
Vol. 17. p.321-329. Proceedings of General Meeting of the
Society for Industrial Microbiology, 32nd, 1975.

Biodegradation, Crude oil, Microorganisms, Bacteria, Estuaries

In the absence of added nitrogen and phosphorus, degradation was minimal after 120 hr of incubation. In the presence of these elements, maximum growth, respiration, and aliphatic utilization occurred during the first 24 hr. No even or odd chain preference was observed. Extended incubation for 672 hr revealed that aliphatics were preferentially utilized. Decomposition of filter-sterilized oil by the three bacterial isolates was analyzed by gas chromatography after 108 hr of incubation and results are presented.

2. PHYSICAL CHANGES OF OIL

C-1569-77
BEHAVIOR OF OIL SPILLED IN ICE-COVERED RIVERS
Chen, E. C., et al. 1976.
Environment Canada Scientific Series Report 61. 41p.

Crude oil, Spreading, Behavior, Coalescence, Emulsification, Ice, Rivers

The spreading and behavior of Norman Wells crude oil injected into fresh water under ice was determined experimentally. When injected into still water, the oil separates into droplets and rises to the water-ice interface where the droplets coalesce to form a spreading slick. Under turbulent conditions, stable oil-in-water and water-in-oil emulsions are formed. The spreading oil does not adhere to the ice undersurface, but if the ice continues to grow, alternating layers of oil and ice are formed.

[from Environment Abstracts 7(2):#77-01300. 1977]

C-1570-77
REVIEW OF OIL SPREADING ON THE SEA
Hoult, D. P. 1976.
Effects of Energy-Related Activities on the Atlantic Continental Shelf, Upton, NY, 1975. p.64-69. Proceedings.

Oil slicks, Spreading, Drift, Physical effects, Weathering

The inertia and buoyancy of an oil slick and the drag of the water under it are discussed. These factors influence the rate at which an oil spill spreadsand the effect of currents on its drift. Other factors include: surface tension, different boiling point fractions of the oil, the rate of aging of the oil, wind, waves, and currents.

[from Selected Water Resources Abstracts 10(10):#W77-04940. 1977]

C-1571-77
EVALUATION OF GROUND WATER DEGRADATION RESULTING FROM WASTE DISPOSAL TO ALLUVIUM NEAR BARSTOW, CALIFORNIA
Hughes, J. L. 1975.
U.S. Geological Survey Professional Paper No. 878. 33p.

Groundwater, Contamination, Wastewater disposal, Spreading, California

The downgradient spreading of plumes of contaminated groundwater polluted by several decades of infiltration from municipal sewage and industrial effluents has been studied. Contaminants include oil, grease, surfactants, phenols, and other organic and inorganic substances. Three-dimensional mapping has established the directions and rates of spreading of the contaminated groundwater plumes toward a U.S. Marine Corps water supply.

[from Environmental Health and Pollution Control 11(3):#773. 1977]

C-1572-77
A MATHEMATICAL MODEL OF EVAPORATION AND DISSOLUTION FROM OIL SPILLS ON ICE, LAND, WATER AND UNDER ICE
Leinonen, P. J., and D. Mackay. 1975.
Water Pollution Research Canada 10:132-141.

Oil spills, Crude oil, Models, Evaporation, Solution, Hydrocarbons, Toxicity

Mathematical models are presented which quantify the processes of evaporation and dissolution of crude oil hydrocarbons on water, ice, land surfaces, and under ice. In surface spills, the lower alkanes (C_1-C_8) are lost 100 times more rapidly by evaporation than by dissolution, the higher alkanes (C>10) evaporate even more rapidly, and the toluene concentration drops rapidly due to its volatility. Naphthalenes, however, dissolve readily and are maintained indefinitely. Under ice, the oil changes very little in composition; therefore, the toxic components have a greater tendency to reach concentrations sufficient to pose a biological threat.

[from Chemical Abstracts 86(18):#126640c. 1977]

C-1573-77
THE PHYSICAL ASPECTS OF CRUDE OIL SPILLS ON NORTHERN TERRAIN
Mackay, D., M. E. Charles, and C. R. Phillips. 1975.
Environmental Social Program Northern Pipelines No. 73-42.
Information Canada Cat. No. R72-9173.

Oil spills, Spreading, Absorption, Ice, Solubility, Behavior, Cleanup, Arctic

This report describes the results of the second year's work in a program to study the physical aspects of crude oil spills on the terrain of the Mackenzie Valley. The following topics are covered: spills on the Mackenzie River; spreading; sorption of land; oil spill studies; oil-snow-ice interactions; aqueous solubility of northern crude oils; prediction of the behavior of arctic oil spills; and cleanup technology.

C-1574-77
THE INTERACTION OF OIL WITH SEA ICE IN THE ARCTIC OCEAN
Martin, S. 1976.
Environmental Assessment of the Alaskan Continental Shelf.
Principal Investigators' Reports for the Year Ending March 1976.
Vol. 14. p.1-7.

Oil spills, Ice, Coasts, Alaska, Arctic Ocean, *Oil-ice interaction

The study concentrates on the small-scale properties of sea ice: salinity, temperature, and crystal structure. Research is divided into a laboratory experiment on ice growth in a wave field, which simulates parts of the Bering Sea, and a field survey which consists of taking ice cores from the Beaufort Sea at different times of the year. Results will be used to outline the various ways in which the sea ice of the Alaskan coast will entrain and interact with an oil spill or blow-out under the ice.

[from Selected Water Resources Abstracts 10(7):#W77-03267. 1977]

C-1575-77
MOVEMENT OF OIL UNDER SEA ICE
Rosenegger, L. W. 1975.
Canada Department of the Environment, Beaufort Sea Technical Report No. 28. 81p.

Crude oil, Movement, Ice

An evaluation of some of the factors affecting the flow and areal distribution of crude oil under a sea ice canopy is presented. Results of laboratory investigations of the following parameters are discussed: interfacial tension and motion of crude oil bubbles under sea ice, penetration of oil into sea ice, equilibrium thickness of a crude oil film on water under arctic conditions, and redistribution of solutes in the oil.

C-1576-77
THE INTERACTION OF WAVES AND OIL SPILL
Stewart, R. J. 1976.
Sea Grant Program Report No. MITSG-75-22. 203p.

Oil spills, Movement, Spreading, *Wave interaction analysis

The combined effects of interfacial elasticity and multiple fluid layer geometrics upon the first order properties of surface waves are analyzed for application to oil spills; the second order mass transit properties are discussed in light of the first. The technique of matched asymptotic expansion is used in conjunction with a small wave amplitude.

[from Selected Water Resources Abstracts 10(6):#W77-02669. 1977]

3. CHEMICAL CHANGES OF OIL

C-1577-77
ON PHOTOCHEMICAL DEGRADATION OF SURFACE FILMS OF PETROLEUM HYDROCARBONS
Hansen, H. P. 1974.
Copenhagen, International Council for the Exploration of the Sea, Fisheries Improvement Committee, 1974. 19p.

Decomposition, Oil slicks, Hydrocarbons, *Photochemical degradation

Summary not available.

[from On Effects of Oil Pollution in Arctic and Subarctic Waters. Seattle, Northwest Marine Fisheries Center. September, 1976]

4. GENERAL FATE OF OIL

C-1578-77
RECENT SEDIMENTATION AND POLLUTION OF THE GULF OF LION CONTINENTAL PLATEAU BETWEEN FOS-SUR-MER AND SETE
Aloisi, J. C., G. Canovet, F. Gadel, H. Got, A. Monaco, F. Vile, C. Causse, and M. Pagnon. 1976.
Bulletin du Bureau Recherches Geologigues et Minieres (France) Section 4(2):69-83.

Hydrocarbons, Sedimentation, Rivers, France, Flocculation, *Gulf of Lion

In a sedimentological and geochemical study of pollution of the Rhône River mouth and Gulf of Lion, the area of Sete Frontignon contained up to 250 mg hydrocarbons/kg marine sediments. Hydrocarbons and other pollutants were concentrated in shallow waters at the river mouth where sedimentation was high because of nearshore flocculation.

[from Chemical Abstracts 86(12):#78415j. 1977]

C-1579-77
ARGO MERCHANT RESPONSE TOLD IN PRELIMINARY NOAA REPORT (news brief)
Anon. 1977.
Sea Technology 18(5):36-37.

Argo Merchant spill, Fuel oil, Biological effects, Fate, Marine organisms, Contamination, NOAA, Atlantic ocean

The results of a preliminary NOAA study of the Argo Merchant tanker oil spill are reviewed. The study reported that the No. 6 fuel oil carried by the tanker did not enter the water column but formed large "pancakes"; that contamination did not exceed 250 ppb, and this was diluted to background levels in a few days; and that no oil was observed on the ocean floor under the spill area. However, zooplankton near the spill area were contaminated, as were pollock eggs and sand launce larvae near the spill site. Impact on seabirds and mammals is believed to have been minor.

C-1580-77
COMPUTERS GO INTO OIL-SPILL FORECAST
Anon. 1977.
Noroil 5(3):25,27,29,31.

Models, Oil spills, Cost analysis, Environmental effects, North Sea, *Computer simulation

Shell International has developed a computer simulator designed to quantify the environmental effects of an oil well blowout in the open sea. SLIKTRAK simulates offshore oil spills, cleanup effects, and their associated costs,and provides a fast and objective evaluation of pollution costs and combat requirements. This technique has been applied to the North Sea and results have shown shore pollution to be less than five percent of the spill volume.

[from Petroleum Abstracts 17(22):#233,872. 1977]

C-1581-77
CONTAMINATION SHORT-LIVED FOLLOWING NORTHEAST SPILL (news brief)
Anon. 1977.
Petroleum Engineer International 49(6):11-12.

Argo Merchant spill, Fuel oil, Fate, Contamination, Marine organisms, Fisheries, Models, Movement, NOAA, Atlantic Ocean

Conclusions of a recent NOAA preliminary report on the"Argo Merchant"tanker oil spill are presented. The spill off the coast of Massachusetts apparently caused no great contamination of the seawater or ocean floor but may have had some impact on the marine ecosystem. Possible effects of the spill on fisheries are currently under investigation. A valuable spin-off of the spill was the opportunity to compare the results of various computerized spill movement models with the day to day behavior of the real spill, and results of this simulation are reported.

C-1582-77
WHERE GOES THE OIL
Anon. 1977.
Nature 267(5607):100.

Offshore drilling, Oil spills, Fate, Evaporation, Dispersions, Spill recovery, North Sea, *Ekofisk well blowout

The remarkably rapid disappearance of most of the 12,000 tons of oil that were spewed out during the April, 1977, Ekofisk offshore oil well blowout is discussed. Natural processes of evaporation and dispersion removed about 90% of the spilled oil within days after the well was capped; about 1000 tons were recovered by Norwegian spill response teams.

C-1583-77

SIMULATED OIL SPILL TRAJECTORIES FOR GULF STREAM WATERS
Bishop, J. M., and F. A. Godshall. 1976.
Gulfstream 11(5):6-7.

Fate, Oil spills, Movement, Models, *Gulf Stream

Summary not available.

[from Underwater Information Bulletin 8(6):#7612/1346. 1976]

C-1584-77

DISTRIBUTION OF HYDROCARBONS IN A SALT MARSH ECOSYSTEM AFTER AN OIL SPILL AND PHYSIOLOGICAL CHANGES IN MARSH ANIMALS FROM THE POLLUTED ENVIRONMENT
Burns, K. A. 1975.
Ph.D. Thesis, Massachusetts Institute of Technology/Woods Hole Oceanographic Institution.

Oil spills, Fate, Distribution, Hydrocarbons, Marshes, Biological effects, Metabolism, Marine organisms, Massachusetts

Field and laboratory studies were conducted for five years on an accidentally oiled marsh and an unpolluted control marsh in Buzzards Bay, Massachusetts. Data from this study have contributed information on the following: incorporation of oil into sediments and organisms; residence time of certain oil components in the marsh ecosystem; physical and chemical weathering and biodegradation of oil in a salt marsh; effects of oiled sediments on the abundance, distribution, behavior and survival of the intertidal fiddler crab, Uca pugnax; hydrocarbon metabolism in Uca pugnax; the presence of inducible microsomal mixed function oxidase (MFO) enzyme system in the fish, Fundulus heteroclitus; and the physiological basis for the sensitivity and adaptability of marsh animals to oil pollution.

C-1585-77

TRANSPORT OF POLLUTANTS IN THE VICINITY OF PRUDHOE BAY, ALASKA
Callaway, R. J., and C. Koblinsky. 1976.
Environmental Assessment of the Alaskan Continental Shelf.
Principal Investigators' Reports for the Year Ending March 1976.
Vol. 11. p. 427-755.

Models, Contaminants, Fate, Movement, Offshore drilling, Prudhoe Bay, *Ocean circulation, *Pollutant transport

The objectives of the study are to determine flushing rates, retention times, and pollutant transport in the vicinity of Prudhoe Bay and relate these to potential drilling operations in the area. A single-layer model of circulation was applied in order to compute tidal elevations and surface currents. Inferences were made from the computer output as to probable transport rates and pollutant dispersion.

[from Selected Water Resources Abstracts 10(7):#W77-03238. 1977]

C-1586-77
OPERATIONAL MODE FOR PREDICTING THE MOVEMENT OF OIL IN CANADIAN NAVIGABLE WATERS
Environment Canada. 1975.
Manuscript Report Series No. 37. p. 1-30.

Oil slicks, Movement, Models, Canada

A feasibility study to develop and evaluate computer prediction of the movement of oil slicks in Canadian navigable waters is presented. Guidelines for establishing a data bank on the topographies of the water bodies, climatology of the various regions, and tidal currents in different locations are developed. Descriptions of the computer programs and the relevant subroutines are included.

[from Summaries of Foreign Government Environmental Reports NTISUB/B/135-76/007. p. 23. 1976]

C-1587-77
A PROBABILISTIC APPROACH FOR OIL DISPERSION AT SEA
Fallah, M. H., and R. M. Stark. 1976.
Ocean Engineering 3(3):145-156.

Models, Fate, Dispersions, Oceans, Spill containment, Environmental effects, Marine organisms

"A random walk model is used to describe the dispersion of oil at sea. Expressions are derived for the characteristic function and probabilities of the random volume of diffused oil." Calculations are made for a Poisson process and a circular oil slick. "The model may be used to assess the impact of vertically diffused oil on marine life and to evaluate the effectiveness of oil containment procedures."

[from Oceanic Abstracts 14(2):#77-01498. 1977]

C-1588-77
PHYSICAL OCEANOGRAPHY OF THE GULF OF ALASKA
Favorite, F., and J. H. Johnson. 1976.
Environmental Assessment of the Alaskan Continental Shelf.
Principal Investigators' Reports for the Year Ending March 1976.
Vol. 11. p. 787-922.

Oil spills, Movement, Offshore drilling, Gulf of Alaska, Baseline studies, *Ocean circulation

This is a concise summary with emphasis on water circulation and transport. It should assist in determining the location and intensity of direct current measurements required to define patterns in this flow regime, thereby determining the potential movement of oil spills from offshore drill sites.

[from Selected Water Resources Abstracts 10(7):#W77-03241. 1977]

C-1589-77
POLLUTED MUDS OF THE PARRAMATTA RIVER
Furzer, I. A. 1975.
Search 6(1-2):39-40.

Contamination, Rivers, Sediments, Biodegradation, *Parramatta River, *Muds

The dissolved oxygen content of the river is so low that anaerobic conditions exist and oils, grease, waxes and tars resist microbial action when found in the muds.

[from Ecological Abstracts 1976(4):#76L/2814. 1976]

C-1590-77
NUMERICAL STUDIES OF ALASKAN REGION
Galt, J. A. 1976.
Environmental Assessment of the Alaskan Continental Shelf.
Principal Investigators' Reports for the Year Ending March 1976.
Vol. 11. p. 107-211.

Models, *Circulation, OCS, Oil spills, Fate, Alaska, *Trajectory analysis, Baseline studies

The numerical modeling and simulation studies are designed to provide information on advection and diffusion processes, aid in interpretation of observational data, and present the results in an integrated form. The modeling studies along with the rest of the physical oceanography program have been able to describe circulation patterns for some of the OCS region in considerable detail. In other areas, dominant physical processes have been identified and simulations initiated.

[from Selected Water Resources Abstracts 10(7)#W77-03231. 1977]

C-1591-77
OUTER CONTINENTAL SHELF ENERGY PROGRAM
Hansen, D. V. 1976.
Environmental Assessment of the Alaskan Continental Shelf.
Principal Investigators' Reports for the Year Ending March 1976.
Vol. 11. p. 267-274.

Offshore development, Oil spills, Fate, OCS, Gulf of Alaska, *Ocean circulation, *Flow trajectories, Baseline studies

Near surface flow trajectories throughout the N.E. Gulf of Alaska OCS region are being studied with emphasis on the lease area from Yakutat Bay to Prince William Sound. The NIMBUS-6 satellite and associated TWERLE/RAMS system are being used to acquire this information. Development of improved diagnostic models allows prediction of pollutant trajectories based on the distribution of basic parameters.

[from Selected Water Resources Abstracts 10(7):#W77-03234. 1977]

C-1592-77
MOVEMENT OF SPILLED OIL OVER THE BEAUFORT SEA SHELF - A FORECAST
Hufford, G. L., I. M. Lissauer, and J. P. Welsh. 1976.
Final report, CGR/DC-12/76; USCG-D-101-76. 90 p.

Oil slicks, Coasts, Movement, Beaufort Sea, *Impact locations

Projections of oil slick movements and their impact locations were determined from fifteen potential drilling sites in the Beaufort Sea. Impact locations were forecast using two approaches: the first emphasizes meteorology and water movement; the second considers the interactions of the environment processes in determining potential movement and impact of spilled oil.

[from Government Reports Announcements 77(5):#AD-A033 580/2GA. 1977]

C-1593-77
HISTORICAL AND STATISTICAL OCEANOGRAPHIC DATA ANALYSIS AND SHIP OF OPPORTUNITY PROGRAM
Muench, R. D. 1976.
Environmental Assessment of the Alaskan Continental Shelf.
Principal Investigators' Reports for the Year Ending March 1976.
Vol. 11. p. 359-425.

*Circulation, Bering Sea, Offshore development, Contamination, Food Web, Fisheries, *Bristol Bay

Data obtained in the Unimak Pass-Bristol Bay region during summer, 1968, supported existing hypotheses that a cyclonic circulation was occurring in that region and that upwelling of deeper water was occurring in central Bristol Bay. A contaminant released near or at the bottom of Bristol Bay could be carried upward to the surface and incorporated into the food chain at the primary productivity level. Such contamination could result in concentration of toxic substances at higher food levels, i.e., fish in Bristol Bay.

[from Selected Water Resources Abstracts 10(7):#W77-03237. 1977]

C-1594-77
THE INTERACTION OF CRUDE OIL WITH ARCTIC SEA ICE
NORCOR Engineering and Research Ltd. 1975.
Canada Department of the Environment, Beaufort Sea Project Technical Report No. 27. 175 p.

Crude oil, Ice, Monitoring, Spreading, Movement, Weathering, Spill cleanup, Arctic

Several experimental discharges of crude oil were injected under sea ice during various stages of ice development from late autumn, 1974, to spring, 1975. The initial spreading of the oil under the ice, the rapid entrapment as droplets and lenses in ice, the gradual upward penetration through the ice, the final surfacing during the arctic spring, and the intervening chemical weathering were continually monitored as part of a study to find countermeasures for combating under-ice oil spills. Upward migration ranged from 15-20 cm/month in February to 150 cm/hour in April. Surface burning of pooled oil was found to be the most effective and efficient cleanup method if a minimum surface film thickness of 0.5 cm was maintained.

C-1595-77
THE FATE OF OIL DISCHARGES IN THE NORTH SEA - A REVIEW OF THE BIOLOGICAL IMPACTS
Sandbrook, R. 1976.
Offshore North Sea Technology Conference, Stavanger, Norway, 1976. Stavanger, Norway, NOROIL Publishing House, 1976. Safety and Environmental Protection Section, Paper S-111/2. 2 p. Summary.

Oil discharges, Fate, Biological effects, Acute effects, Chronic effects, Marine organisms, North Sea

Research on the inputs, general fate, and interaction of oil and petroleum hydrocarbons with the marine environment is reviewed. The processes of physical, chemical, and biological dispersion and degradation are outlined. The impacts of oil on individual species, communities, and the entire marine biological system are discussed; and the acute and chronic effects of oil contaminants on metabolic, behavioral, and reproductive patterns are assessed.

C-1596-77
DISTRIBUTION AND TRANSPORTATION OF SUSPENDED SEDIMENTS
Schubel, J. R. 1976.
Effects of Energy-Related Activities on the Atlantic Continental Shelf, Upton, N.Y., 1975. p. 207-230. Proceedings.

Fate, Oil transport, OCS, EIS, Atlantic Coast, *Suspended matter

Literature on the suspended matter of the waters overlying the Atlantic shelf of the U.S. is reviewed. The significance of this suspended matter as a mechanism for transporting oil and radionuclides back to the coast and to man is discussed. It is the opinion of the author that the state of the art on this subject is adequate for the preparation of environmental impact statements.

[from Selected Water Resources Abstracts 10(10):#W77-04948. 1977]

C-1597-77
BRISTOL BAY OCEANOGRAPHIC PROCESSES (B-BOP)
Schumacher, J. D., and L. K. Coachman. 1976.
Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Report for the Year Ending March 1976. Vol. 11. p. 213-247.

*Ocean circulation, OCS, Fate, Contaminants, Offshore development, Alaska, Baseline studies

The project objective was to relate oceanic advective and diffusive processes to potential problems due to OCS petroleum development. Conclusions made from data collected to date are given.

[from Selected Water Resources Abstracts 10(7):#W77-03232. 1977]

C-1598-77
THE CONTINUOUS SPILLING OF HOT OIL ON ICE
Siu, S. K., and C. R. Phillips. 1977.
Journal of Canadian Petroleum Technology 16(1):31-34.

Oil spills, Ice, Spreading, *Oil temperature, *Ice temperature, *Spilling rate

The continuous spilling of hot Norman Wells crude oil onto an ice surface was investigated by measuring oil temperature, ice temperature, and spilling rate. An equation for spreading of the oil was developed in which the oil slick area A was proportional to $t^{1.2}$, where t is the elapsed time. Experimental data showed that A was proportional to $t^{0.8}$. "Increases in oil and ice temperatures were found to cause an increase in A, and temperature effects could be taken into account by relating kinematic viscosity to a function of the geometric mean of the ice and oil temperatures."

C-1599-77
DOCUMENTATION OF FOUR OCEAN-RELATED COMPUTER MODELS
Yeung, R. W. 1976.
Technical report, MITSG-76-18, NOAA-77011109. 73 p.

Models, Fate, Oil spills, Oceans, *Computer programming

The first program, MCTRAJ, is the offshore oil-spill trajectory-simulation program which is based on a trajectory equation. NEARSHORE is the nearshore oil-spill tracking-simulation program based on a trajectory equation. T14TRAN is a program which takes as input formatted data tape prepared by the National Climatic Center and generates as output the resultant probabilistic wind transition matrices to be used by MCTRAJ and NEARSHORE. TWOFOIL is a program which seeks the solution of the two-dimensional lifting flow about two symmetric bodies.

[from Government Reports Announcements 77(9):#PB-264 146/2GA. 1977]

F. OIL POLLUTION REGULATIONS

1. STATE LEGISLATION

C-1601-77
NO TITLE GIVEN (news brief)
Anon. 1977.
Environmental Science and Technology 11(6):542.

Regulations, Legislation, Compensation, Spill cleanup, State governments, Oil transfer, New Jersey

The New Jersey Department of Environmental Protection has adopted regulations and a list of oil and hazardous substances subject to a 1¢/bbl transfer tax under New Jersey's new Spill Compensation and Control Law. The taxes will go toward a spill cleanup and damage compensation fund.

C-1602-77
MILLER ANTI-POLLUTION ACT OF 1971 (ABSOLUTE LIABILITY OF PETROLEUM CARRIER)
Anon. 1976.
Cal Harbors and Navigation Code sec 293.

Legislation, Oil spills, Liability, Tankers, Oil transport, California

California legislation is described holding liable the owner or operator of any vessel which commercially transports petroleum or fuel oil without regard to fault for any property damage within the state. Liability also applies to damage of natural resources and navigable waters of the state.

[from Selected Water Resources Abstracts 10(3):#W77-01123. 1977]

C-1603-77
MODEL USED OIL RECYCLING ACT
Irwin, W. A. 1976.
Washington, D. C., Environmental Law Institute, 1976. 12 p.

Legislation, Waste oil, Recycling, State governments, *Local governments

A model bill designed for state and local governments interested in adopting programs for recycling used oil is presented. The bill would provide a comprehensive but flexible program for oil recovery, collection, and recycling.

[from Energy Abstracts for Policy Analysis 3(4):1201. 1977]

2. U.S. LEGISLATION

C-1604-77
OIL SPILL LIABILITY BILL MAKES PROGRESS IN HOUSE (news brief)
Anon. 1977.
Sea Technology 18(5):38.

Legislation, U.S. Liability, Compensation, Spill cleanup

Progress of a bill that would legislate a comprehensive oil spill liability and compensation scheme, H.R. 3711, is described. The bill would set maximum liabilities for vessels at $30 million, and for oil refineries, $50 million. The bill would also establish a $200 million "superfund" to be used if spill liability is exhausted and additional cleanup costs or third party claims remain.

C-1605-77
ON THE HILL--WATER POLLUTION (news brief)
Anon. 1977.
Environmental Action 8(24):9.

Legislation, Liability, Oil spills, Safety, Tankers, U.S., *Congressional bills

Two Senate bills and one House bill on oil spill liability and tanker safety are briefly described. These proposals are a result of the "Argo Merchant" spill and would place a $30 million ceiling on total liability and set basic tanker safety standards for U.S. waters.

C-1606-77
A THREAT TO OFFSHORE OIL
Anon. 1976.
Work Boat 33(11):42-44.

Legislation, U.S., Offshore development, Oil-gas leasing, Environmental protection, Onshore impacts, *OCS Lands Act Amendments

Provisions of the Outer Continental Shelf Lands Act Amendments (OCSLAA) of 1976, under consideration by Congress, are detailed. Among the provisions are various requirements and conditions of OCS oil-gas leasing. The bill is intended to assure coastal states a means for controlling the onshore impact of OCS oil development and to provide for the determination of liabilities for spill cleanup and damage compensation.

C-1607-77

OIL ON TROUBLED WATERS DOES NOT CALM THE LEGAL SEAS
Kuffler, A. J. 1975.
Society of Naval Architects and Marine Engineers Section Meeting, Philadelphia, 1975. 38 p.

Legislation, U.S., Oil spills, Ships, Tankers, International agreements, *Legal problems

The major elements of federal legislation concerning oil spills from vessels are outlined and selected legal problems which this legislation presents are detailed. The article also comments on some legal issues raised by existing and proposed international agreements dealing with oil spills from vessels and particularly tankers.

[from MRIS Abstracts 14:#14 139965. 1976]

C-1608-77

DAMAGE COMPENSABLE UNDER FEDERAL MARITIME LAW FOR INJURIES CAUSED BY DISCHARGE OF OIL INTO NAVIGABLE WATERS
Rydstrom, J. F. 1976.
26 ALR Fed 346-58. 13 p.

Legislation, Oil discharges, Liability, Compensation, U.S., State governments, *Navigable waters

Since the Federal Water Pollution Control Act of 1972 limits its provisions to illegal oil discharge damage claims relating to cleanup costs of the Federal government, states are left free to impose liability in damages for losses suffered by both states and private parties. States have been allowed to recover damages for the cost of cleanup and also as parens patriae for damage done to marine life. Private parties also may recover damages for destruction of marine life due to oil spill when they can show an injury different in kind from the general public (i.e. commercial fisherman).

[from Selected Water Resources Abstracts 10(8): #W77-03711. 1977]

C-1609-77

COMMENTS ON UNDERGROUND INJECTION CONTROL PROVISIONS OF SAFE DRINKING WATER ACT
Shakely, S. F. 1976.
Interstate Oil Compact Comm. Comm. Bulletin 18(2):50-52.

Legislation, U.S., *Underground injection, Production, Water quality, EPA

The act provides that "the Administrator may not prescribe requirements which interfere with or impede the underground injection of brine or other fluids which are brought to the surface in connection with oil or natural gas production or any underground injection for the secondary or tertiary recovery of oil or natural gas unless such requirements are essential to assure that underground sources of drinking water will not be endangered by such injection." Congress gave a mandate to the EPA to propose regulations to comply with provisions of the law. The proposed rules are discussed with respect to how they affect current water supply.

[from Petroleum Abstracts 17(19): #233,282. 1977]

C-1610-77
LEGISLATIVE DEVELOPMENTS - DEEPWATER PORT ACT OF 1974
Stephenson, A. W. 1975.
Law and Policy in International Business 7(4):1271-1285.

Legislation, U.S., Ports, Tankers, Oil transport, Liability, Cost analysis, *Deepwater Port Act

The use of very large crude carriers to transport oil rather than smaller tankers would save $1.5 billion in shipping costs in 1985 and could reduce oil spills by more than 90% over a 20 year period. To accommodate these vessels, the Deepwater Port Act was passed by Congress in 1974 to encourage construction of such ports. The major provisions of the Act are discussed including licensing, state veto/power, environmental provisions, and liability.

[from Selected Water Resources Abstracts 10(10): #W77-05056. 1977]

3. INTERNATIONAL LEGISLATION

C-1611-77
DIVERGENT STANDARDS OF NATIONAL OIL POLLUTION LEGISLATION
Ruester, B. 1976.
Environmental Law: International and Comparative Aspects: A Symposium. J. Nowak (ed.). London, British Institute of International and Comparative Law, 1976. p. 114-132.

Legislation, U.S., Foreign governments, Oil discharges, Pollution prevention, Liability

A representative cross-section of oil pollution legislation of major maritime countries is reviewed. Topics emphasized include: limitation and prohibition of intentional oil discharges into the sea, the prevention of oil casualties, the elimination of oil pollution from accidents, and the liability for damage caused by pollution.

[from Oceanic Abstracts 14(1): #77-00979. 1977]

4. FOREIGN LEGISLATION

C-1612-77
CIVIL LIABILITY FOR POLLUTION FROM OFFSHORE OPERATIONS: THE NORWEGIAN VIEW
Fleischer, C. A. 1976.
Environmental Policy and Law 2(1):3-5.

Regulations, Liability, Offshore development, North Sea, Norway

The need to unify rules over civil liability for pollution from offshore operations and the limit of liability are discussed. Unlimited liability (presently in force in Norway) is a preferred system in that it gives adequate protection to the victims without placing any unjust burden upon the operator and would not seem to influence the price of oil or companies' interest in the North Sea to any extent. A compromise is suggested to meet the proposal of limited liability.

[from Environmental Health and Pollution Control 11(5): #1071. 1977]

C-1613-77
THE FIGHT AGAINST ACCIDENTAL OIL POLLUTION VIS-A-VIS FRENCH MARITIME LAW [in French]
Langavant, E., and J.-P. Beurier. 1976.
Le Droit Maritime Francais No. 333. p. 515-524.

Legislation, Pollution prevention, Tankers, France, *French maritime law, *Olympic Bravery spill

The legislative problems involved in the wreck of the oil-tanker, "Olympic Bravery," in 1976, and the accidental oil pollution of Brittany, France, are examined. International legislation is described and the attitude of the French government is explained as a function of French maritime law.

[from Aquatic Sciences and Fisheries Abstracts 7(2): #7Q1919. 1977]

5. AGREEMENTS AND CONVENTIONS

C-1614-77
INTERNATIONAL POLLUTION CONTROL IS TOO SLOW (news brief)
Anon. 1977.
Marine Pollution Bulletin 8(3):52.

International conventions, Regulations, Tankers, Segregated ballast, Pollution control

The 1973 International Convention on Prevention of Pollution of the Sea reduced allowable discharge levels from 1/15,000 to 1/30,000 of the cargo carried and stipulated that all new ships over 70,000 dwt must be built with segregated ballast to prevent oil residues from mixing with ballast seawater. It is feasible that these regulations may not be implemented until the 1980's.

C-1615-77
IMCO CONVENTION ON THE POLLUTION OF COASTAL WATERS AND HARBORS
Busha, T. 1976.
Environmental Law: International and Comparative Aspects: A Symposium. J. Nowak (ed.). London, British Institute of International and Comparative Law, 1976. p. 85-97.

International conventions, Coasts, Harbors, Pollution prevention, Ships, Liability, Compensation, IMCO

IMCO legal and technical regimes to minimize pollution from ships and conventions regulating liability and compensation for damage from oil pollution from ships are reviewed. States should accept international standards for the protection of their vital coastal interests because a major source of the oil pollution to coastal waters is ships - the function, direction, and control of which are international in character.

[from Oceanic Abstracts 14(1): #77-00976. 1977]

C-1616-77
INTERNATIONAL CONVENTIONS RELATING TO POLLUTION RESULTING FROM OFFSHORE OIL ACTIVITIES IN THE NORTH SEA AREA
Hambro, C. 1976.
Offshore North Sea Technology Conference, Stavanger, Norway, 1976. Stavanger, Norway, NOROIL Publishing House, 1976. Safety and Environmental Protection Section, Paper S-111/5. 13 p. Summary.

International conventions, Pollution control, Regulations, Liability, Offshore development, North Sea, Europe

European measures to prevent or control offshore oil pollution and to assess civil liability for oil pollution damages from offshore activities are reviewed, and the most important provisions outlined. Included are the Oslo Convention of 1972, the London Convention of 1972, and the 1975 IMCO Convention on Marine Pollution, the Paris Convention of 1974, the Bonn agreement, and the Civil Liability Convention which was initiated in London in 1975.

C-1617-77
THE 1973 MARINE POLLUTION CONVENTION. PROBLEMS AND SOLUTIONS
Horrocks, J. C. S. 1977.
Marine Policy 1(1):52-60.

International conventions, Tankers, Pollution prevention, Oil discharges, Oil-water separation, Monitoring, IMCO

Provisions of the 1973 International Convention for the Prevention of Pollution are briefly outlined, and three major problem areas which remain to be solved are identified and described. These are: (1) the effectiveness of oil-water separation equipment and oil content monitors; (2) the adequacy of reception facilities for oil and chemical residues; and (3) the enforcement of discharge requirements for chemical carriers. Efforts being made by IMCO, its member governments, and the tanker industry to solve those and related problems are discussed.

C-1618-77
MARINE POLLUTION AND INTERNATIONAL LAW
Ketchum, B. H. 1975.
Proceedings of the Third International Biodegradation Symposium. J. M. Sharpley, and A. M. Kaplan (eds.). Barking, Essex, Applied Science Publishers, Ltd., 1976. p. 11-20.
Symposium held in Kingston, Rhode Island, 17-23 August, 1975.

International conventions, Pollution prevention, Legislation, IMCO

Recent international concern with marine pollution by oil and hazardous substances, radioactivity, and ocean dumping has resulted in a number of international conventions beginning with the IMCO-sponsored 1954 International Convention for the Prevention of Pollution of the Sea by Oil. The provisions of this Convention and its subsequent amendments, and other related conventions up to 1975 are briefly discussed.

C-1619-77
INTERNATIONAL ACTION ON SHIP-GENERATED OIL POLLUTION (editorial)
Baroness White. 1977.
Marine Pollution Bulletin 8(3):54-57.

Oil discharges, Ships, Pollution control, International conventions, Law enforcement , Oil-water separation

The international conventions and agreements regulating ship-generated oil pollution are discussed and the problem of enforcing these regulations due to inadequate oil-water separation equipment is presented. Various legal problems associated with conventions and international laws, as well as pollution control agreements, are reviewed.

6. STANDARDS AND GUIDELINES

C-1620-77
INTERNATIONAL OIL TANKER AND TERMINAL SAFETY GUIDE. SECOND EDITION
Anon. 1975.
New York, Halstead Press, 1975. 259 p.

Crude oil, Petroleum products, Oil transfer, Tankers, Safety, Guidelines, *Terminals

This book presents safety guidelines for the handling of crude oil and petroleum products at a terminal and on a tanker at a terminal.

[from Energy Abstracts for Policy Analysis 3(1): #304. 1977]

C-1621-77
STATUS REPORT ON ABATEMENT OF WATER POLLUTION FROM THE CANADIAN PETROLEUM REFINING INDUSTRY - 1975
Canada Department of the Environment, Petroleum and Industrial Organic Chemicals Program. 1976.
Environmental Protection Service report Series, Economic and technical review report, EPS 3-WP-76-11. 63 p.

Pollution control, Refineries, Wastewaters, Regulations, Guidelines, Monitoring, Canada

The effectiveness of recently issued refinery effluent regulations and guidelines is evaluated. No significant reductions in oil and grease levels have been achieved on a national scale in the years 1972-1975. High priority is presently given to effluent monitoring programs that assess the compliance of individual Canadian refineries with these regulations and guidelines.

[from Pollution Abstracts 8(3): #77-02442. 1977]

C-1622-77
STIFFER REGULATIONS ARE SEEN IN DIRTY WAKE OF OIL TANKERS (news brief)
Foss, W. O. 1977.
National Fisherman 57(11):24A-25A.

Oil transport, Tankers, Regulations, Safety, Liability, USCG

As a result of the rash of recent oil tanker accidents, new legislation is seen for U.S. waters on tanker safety and liability. Regulations restricting oil transport are presented, and the duties of the U.S. Coast Guard's fisheries expert are discussed.

C-1623-77
NIOSH HEALTH AND SAFETY GUIDE FOR BULK PETROLEUM PLANTS
National Institute for Occupational Safety and Health. 1975.
Cincinnati, Ohio, National Institute for Occupational Safety and Health, 1975. 82 p.

Oil industry, Storage, Health hazards, Safety, Guidelines, *Bulk petroleum plants

Guidelines for providing a safe and healthful work environment in bulk petroleum plants are presented. Hazards common to petroleum storage plants and means of eliminating such hazards are pointed out, and a checklist for identifying and rectifying problems is included.

[from Energy Abstracts for Policy Analysis 3(2): #595. 1977]

G. BIBLIOGRAPHIES

C-1624-77
A COLD REGION OIL POLLUTION BIBLIOGRAPHY
Arctec, Inc., 9104 Red Branch Rd., Columbia, MD. 1976.

Bibliographies, Oil slicks, Containment, Recovery, Oil transfer, Storage, Spill disposal, Biodegradation, Arctic, Ice

The bibliography covers the following areas of aquatic and terrestrial oil pollution: containment, recovery, transfer, storage, disposal, and oil pollution sensing for cold regions; burning slicks in cold regions; biodegradation of oil; and interaction of oil pollutants with snow and ice environments.

C-1625-77
PETROLEUM
Fraser, J. M. 1977.
Analytical Chemistry 49(5):231R-273R.

Bibliographies, Oil industry, Chemical analysis, Oil spills, Source identification, Hydrocarbons, Marine organisms

This is a review of analytical chemistry in the petroleum industry which covers relevant publications appearing essentially in 1974 and 1975. Oil spill identification, monitoring hydrocarbons in the marine environment, and pollution analysis and instrumentation are subjects included.

C-1626-77
OFFSHORE PIPELINES (A BIBLIOGRAPHY WITH ABSTRACTS)
Habercom, G. E. 1977.
Report for 1964 - January 1977. 99 p.

Bibliographies, Pipelines, Oil transport, Offshore development, Environmental effects

Construction, utilization, wave action, and environmental aspects of offshore pipelines are investigated. Hydrodynamics, costs benefits of underwater pipeline transportation, and risk analysis are among the parameters researched.

[from Government Reports Announcements 77(9): #NTIS/PS-77/0098/2GA. 1977]

C-1627-77
BIODETERIORATION OF OIL SPILLS (A BIBLIOGRAPHY WITH ABSTRACTS)
Harrison, E. A. 1977.
Report for 1964 - January 1977. 110 p.

Bibliographies, Biodegradation, Oil spills, Hydrocarbons, Bacteria, Algae, Spill cleanup

The bibliography contains 105 abstracts which report on algae, hydrocarbons, petroleum degradation, oil spills, beach cleanup, and microbial degradation as related to biodeterioration of oil spills.

[from Government Reports Announcements 77(7): #NTIS/PS-77/0046/1GA 1977]

C-1628-77
ENDANGERED SPECIES (A BIBLIOGRAPHY WITH ABSTRACTS). REPORT FOR 1964 - NOV. 1975
Harrison, E. A. 1975.
NTIS/PS-75/092. 44 p.

Bibliographies, Wildlife, Marine organisms, Birds, Contamination, *Endangered species, *Water pollution

"The bibliography of selected abstracts covers wildlife management, animal ecology, plant ecology, aquatic animals, birds, highway construction, air pollution,and water pollution as related to endangered species. (This updated bibliography contains 39 abstracts, 10 of which are new entries to the previous edition.)"

[from ERDA Energy Research Abstracts 2(6): #14663. 1977]

C-1629-77
ASSESSMENT OF AVAILABLE LITERATURE ON EFFECTS OF OIL POLLUTION ON BIOTA IN ARCTIC AND SUBARCTIC WATERS
Malins, D. C., and M. E. Stansby. 1976.
Environmental Assessment of the Alaskan Continental Shelf.
Principal Investigators' Reports for the Year Ending March 1976.
Vol. 8. p. 155-320.

Bibliographies, Oil spills, Marine organisms, Biological effects, Arctic, Subarctic regions, Baseline studies

A bibliography with abstracts is presented of all available literature on the effects of oil pollution on biota in arctic and subarctic waters. Information is tabulated under 20 subject headings.

[from Selected Water Resources Abstracts 10(4): #W77-01871. 1977]

C-1630-77
LITERATURE SEARCH ON THE DENSITY AND DISTRIBUTION OF FISHES OF THE BEAUFORT SEA
Morrow, J. E. 1976.
Environmental Assessment of the Alaskan Continental Shelf.
Principal Investigators' Reports for the Year Ending March 1976.
Vol. 7. p. 533-541.

Bibliographies, Fish, Distribution, Offshore development, Biological effects, Beaufort Sea

An annotated bibliography has been prepared on the population density and distribution of fishes in the Beaufort Sea as part of an effort to bring together information that will help ameliorate or avoid adverse impacts of OCS oil-gas activities on the marine biota.

[from Selected Water Resources Abstracts 10(4): #W77-01860. 1977]

C-1631-77
ESTUARINE POLLUTION. A BIBLIOGRAPHY. VOLUME 3
Office of Water Research and Technology, Water Resources Scientific Information Center. 1976.
OWRT/WRS1C-76-208-W77-04110. 570 p.

Bibliographies, Estuaries, Coasts, Contamination

"This report, containing 373 abstracts, is another in a series of planned bibliographies in water resources produced from the information base comprising Selected Water Resources Abstracts. Volume 3 covers the period from April, 1974, to September, 1976. Author and subject indexes are included."

[from Government Reports Announcements 77(9): #PB-263 772/6GA. 1977]

C-1632-77
REVIEW OF LITERATURE AND HISTORICAL DATA ON NON-SALMONID PELAGIC FISHERIES RESOURCES OF THE EASTERN BERING SEA AND GULF OF ALASKA
Pereyra, W. T., and M. O. Nelson. 1976.
Environmental Assessment of the Alaskan Continental Shelf.
Principal Investigators' Reports for the Year Ending March 1976.
Vol. 6. p. 59-73.

Bibliographies, Fish, *Non-salmonid pelagic fishes, Bering Sea, Gulf of Alaska, Baseline studies

Available literature on approximately 20 species of non-salmonid pelagic fishes of the title area has been reviewed and is included as an annotated bibliography. This review is part of the baseline data acquired to evaluate the possible effects of offshore oil-gas development on the Alaskan Continental Shelf.

[from Selected Water Resources Abstracts 10(4): #W77-01845. 1977]

C-1633-77
A SELECTED RESEARCH BIBLIOGRAPHY ON OIL POLLUTION
Sharma, P. C. 1976.
Monticello, Illinois, Council of Planning Libraries, 1976. 11 p.

Bibliographies, Oil spills, Fate, Biological effects, Marine organisms, Spill cleanup

The bibliography contains over 125 selected references on oil pollution research published during 1930-1974. The bibliography is divided into two parts: a listing of books and a listing of articles and periodicals.

SECTION II: CURRENT RESEARCH PROJECTS

Title, contract information and a summary of project objectives are provided in each entry. Project notices have been obtained from the Smithsonian Science Information Exchange (SSIE), and from the Maritime Research Information Service Abstracts. Current status information and publications resulting from the projects are presented when such information is available from the principal investigators or performing organizations. The source of status information is given at the end of each entry.

Entries are grouped according to subject and then ordered by serial number within each subject division. The serial number designates the original issue of OIL SPILL AND OIL POLLUTION REPORTS in which the research project is listed:

R-166-74 to R-244-74	EPA-670/2-75-044 November 74 to February 75
R-245-74 to R-268-74	EPA-670/2-75-059 February 75 to April 75
R-269-75 to R-304-75	EPA-600/2-76-113 August 75 to October 75
R-064-76 to R-123-76	EPA-600/2-76-266 May 76 to July 76
R-124-76 to R-175-76	EPA-600/2-77-037 August 76 to October 76
R-001-77 to R-022-77	EPA-600/2-77-075 November 76 to January 77
R-023-77 to R-039-77	February 77 to April 77
R-040-77 to R-075-77	May 77 to July 77

A. OIL POLLUTION DETECTION AND EVALUATION

1. MONITORING

R-040-77
HYDROCARBON POLLUTION STUDIES - PORT VALDEZ

Principal Investigator:	Unknown
Performing Organization:	Joint State Federal Fish and Wildlife, 628 F St., Anchorage, AK 99501
Supporting Agency:	U.S. Department of the Interior, Alaska Pipeline Office; Alyeska Pipeline Service Co., Inc.
Period:	7/75 to 9/77

Project objectives are to continue to monitor water quality in Port Valdez to determine hydrocarbon levels, determine populations of benthic organisms in Port Valdez, and monitor hydrocarbon levels in the tissues of selected marine organisms in Port Valdez.

[SSIE No. CH-162]

Status: The following tasks have been performed: classification of existing vegetation communities in the marsh, and establishment of permanent transects to measure successional trends and to measure modification of the marsh by pollution.

Reports and Publications

SALT MARSHES OF PORT VALDEZ, ALASKA, AND VICINITY: A BASELINE STUDY
Crow, J. H. 1977.
Final report to the U.S. Department of the Interior. 113p.

In 1974 and 1975, 62 baseline locations were selected for intensive study in the salt marshes of Port Valdez and vicinity. The sites are intended to reflect the impact of oil transport activities. Vegetation and soil characteristics were emphasized. Gold Creek and Sawmill Creek appear to be the marshes most susceptible to major oil spill damage, but all the marshes studied are threatened to some degree. An oil spill associated with seasonal high tides or during the winter when fresh water outflow is minimal would increase the potential hazard to the less vulnerable marsh areas.

Information Source: U.S. Department of the Interior, Fish and Wildlife Service, Bureau of Sport Fish and Wildlife, 813 D St., Anchorage, AK 99501

2. ANALYSIS

R-041-77

DEVELOPMENT OF INSTRUMENTATION FOR HIGH-VOLUME ANALYSIS OF PETROCHEMICAL AND ASSOCIATED COMPOUNDS

Principal Investigators:	Beetum, A., and G. H. Davis
Performing Organization:	U.S. Department of the Interior, Geological Survey, 12201 Sunrise Valley Dr., Herndon, VA 22092
Supporting Agency:	U.S. Environmental Protection Agency, Office of Research and Development. No. IAG-D5-E77B-BX-01
Period:	7/75 to 6/76
Funds:	$95,000

The project was aimed at developing guidelines to be used by management in choosing equipment for high-volume analysis of petrochemical and associated compounds.

[SSIE No. GMA-2972]

C-042-77

CHEMICAL INTERACTION OF ATMOSPHERIC PETROLEUM RESIDUES WITH LAKE SURFACE ORGANIC MICROLAYERS

Principal Investigator:	Eisenreich, S. J.
Performing Organization:	University of Minnesota, School of Engineering, 105 Morrill Hall, Minneapolis, MN 55414
Supporting Agency:	American Chemical Society. No. 9116-G517
Period:	9/76 to 8/77
Funds:	$3,000

The objective of the proposed research is to investigate the chemical interaction of petroleum residues (PR) originating from atmospheric and in-lake sources with surface organic microlayers (SOM) in freshwater lakes. Gas chromatography-mass spectrometric techniques and infrared spectroscopy will be used in quantifying and identifying petroleum residues. Ultimately, the effect of atmospheric inputs of PR and enrichment in SOM will be related to the accumulation of hydrocarbon-soluble hazardous organics (PCB's pesticides, PAH) in aquatic systems.

[SSIE No. PCS-2607]

B. OIL POLLUTION PREVENTION AND CONTROL

1. CONTAINMENT

R-045-77

DEVELOPMENT OF A STREAMLINED OIL RETENTION BOOM

Principal Investigator: Folsom, B.
Performing Organization: Ultrasystems, Inc., 500 Newport Center Dr., Suite 800, Newport Beach, CA 92660
Supporting Agency: U.S. Environmental Protection Agency, Office of Research and Development
Period: 7/75 to 6/76

The aim of this program is to design and test an operational prototype of the streamline oil boom capable of providing optimal collection efficiency under a wide range of current and wave conditions. Phase I (completed) was a preliminary design and feasibility test of the streamlined boom concept. Phase II includes experiments to achieve an understanding of the important flow mechanisms associated with the bow shape, oil separation system, and dynamic behavior of the boom. Phase III includes material selection, design and testing of full-scale prototype boom section.

[MRIS Abstracts 14:#14A 141179. 1977]

R-046-77

DEVELOPMENT OF INNOVATIVE TECHNIQUES FOR THE IMMEDIATE CONTAINMENT OR DISPOSAL OF OIL FROM AN UNDERWATER WELL BLOWOUT IN THE BEAUFORT SEA

Principal Investigator: Unknown
Performing Organization: Arctec Canada Limited, 1440 Ste Catherine W., Montreal, Quebec, Canada
Supporting Agency: Canada. Department of the Environment. No. OSS76-00321
Period: 10/76 to 9/77
Funds: $46,300

Summary not available to SSIE.

[SSIE No. WDB-74]

R-043-77
SOLUBILITIES OF MILITARY FUELS AND LUBRICANTS IN WATER

Principal Investigator: Mengenhauser, J. V.
Performing Organization: U.S. Army, Mobility Equipment Research and Development Com., Fort Belvoir, VA 22060
Supporting Agency: U.S. Department of Defense, Army No. DAOL3758
Period: 7/75 to 6/76

Information on the solubility behavior of "Military Pol" products in water was proposed in order to deal with anticipated environmental regulations. The approach for this work was to treat all the water-soluble compounds in a given oil as a composite. By determining solubilities over a range of oil-water ratios, a partition coefficient would be determined for each Pol product of interest. Effects of other variables such as pH and salt content were also to be studied.

[SSIE No. ZQA-123758-1]

Status: The project was terminated in June, 1976. No formal reports are available.

Information Source: J. V. Mengenhauser, U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, VA 22060

3. SAMPLING

R-044-77
UNDERWAY WATER SAMPLING SYSTEM

Principal Investigator: Kearse, C. D.
Performing Organization: U.S. Department of Commerce, Engineering Development Laboratory, 6001 Executive Blvd., Rockville, MD 20852
Supporting Agency: U.S. Environmental Protection Agency, Office of Research and Development. No. EPA-IAG-05-E693-DX
Period: 8/75 to 7/76
Funds: $145,000

A cost effective shipborne system is being developed with which to measure those physical and chemical parameters which determine the identity, concentration, transport, and distribution of pollutants arising from energy activities in the marine environment. The major elements of the development program consist of: the Current/Depth Measurement Subsystem; the Water Sampling and Measurement Subsystem; the Data Processing, Display and Navigation Subsystem; and System Integration, Test and Techniques Development.

[SSIE No. GMA-3041]

2. CLEANUP AND RECOVERY

R-087-76 (renewal)
OIL RECOVERY MODULE

Principal Investigator:	Unknown
Performing Organization:	Marine Construction and Design Co., Seattle, WA 98199
Supporting Agency:	U.S. Department of Transportation, Office of the Secretary. No. CG58249, Contract CG-51, 465-A
Period:	7/75 to 1/76

The Marine Construction & Design Company conducts continuous engineering work for the development of new models of vessels and equipment for oil spill cleanup. This project "includes engineering service on an as required basis for consulting in conjunction with the Coast Guard testing program."

[SSIE No. GZO-301]

C-085-76 (renewal)
DESIGN AND FABRICATE OILY WATER SEPARATOR FOR USE AS A SUBSYSTEM OF AN OIL SPILL REMOVAL DEVICE

Principal Investigator:	Unknown
Performing Organization:	Foster Miller Associates, Inc., 135 2nd Ave., Waltham, MA 02154
Supporting Agency:	U.S. Department of Transportation, Coast Guard
Period:	7/75 to 6/76

The separator will undergo various tests in order to identify problems resulting from the fabrication or assembly, evaluate the separation performance of the system, and evaluate and refine the automatic control features.

[SSIE No. GZ-58648]

Status: Foster-Miller is currently in the process of writing a final report which will document the effort undertaken in the design, fabrication, and testing of the Spilled Oil Recovery Separator. Upon completion, this report will be printed by the U.S. Coast Guard and distributed by NTIS, Springfield, VA.

Information Source: W. M. Mack, Jr., Foster-Miller Associates, Inc., 135 Second Ave., Waltham, MA 02154

R-047-77

A PORTABLE MAGNETIC RECOVERY UNIT FOR OIL SPILL CONTROL UTILIZING FERROMAGNETIC SORBENTS

Principal Investigator:	Turbeville, J. E.
Performing Organization:	University of Florida, Department of Physics, 4202 Fowler Ave., Tampa, FL 33620
Supporting Agency:	U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Sea Grant Office, No. R/OE-6.
Period:	7/75 to 6/76
Funds:	$35,600

Research is being conducted to design and construct a 24-ft., prototype, magnetic oil recovery unit which will be portable and completely self-contained. Work is continuing to find the best formulation for the ferromagnetic foam and to produce suitable amounts for use in the tests of the pick-up unit.

[SSIE No. GBP-2511]

Status: On April 27, 1977, the recovery unit was launched in Tampa for preliminary tests of the concept. Tests were performed using the ferromagnetic sorbent material, but without the presence of oil. The vessel operated quite well with respect to the magnetic pick-up; work is continuing on the wringer mechanism.

Reports and Publications

A FERROMAGNETIC SORBENT SYSTEM FOR OIL SPILL RECOVERY
Turbeville, J. E. 1976.
Offshore Technology Conference, 8th, Houston, 1976. Paper no. OTC-2693. Vol. 3. p.883-888.

A totally new technique for oil spill recovery is described. The technique is based on the use of ferromagnetic sorbents made either from small polystyrene spheres or sponge-like, reusable polyurethane foam. The ferromagnetic sorbents, once saturated with oil, are easily recovered and collected by magnetic means.

Information Source: J. E. Turbeville, University of South Florida,
Department of Physics, 4202 Fowler Ave.,
Tampa, FL 33620

3. RESTORATION

R-048-77
EVALUATION OF SELECTED SURFACE TREATMENT AGENTS FOR THE PROTECTION AND RESTORATION OF SHORELINE AND SALT MARSH AREAS

Principal Investigators:	Sartor, J. D., et al.
Performing Organization:	American Petroleum Institute, 1801 K St., N.W., Washington, D.C. 20006
Supporting Agency:	U.S. Environmental Protection Agency, Office of Research and Development. No. R80463901
Period:	8/76 to 7/77
Funds:	$75,000

The selected agents for protection and restoration of shoreline and salt marsh areas from oil spills are those recommended by four laboratory scale projects funded by the American Petroleum Institute. This project proposes to evaluate the effectiveness of these agents in "real world" situations by conducting full scale field tests using spilled oil at test areas to which the treating agents have been applied.

[SSIE No. GMA-3084]

4. WASTE TREATMENT AND DISPOSAL METHODS

R-090-76 (renewal)
OIL-WATER SEPARATION BY INDUCED-AIR FLOTATION

Principal Investigator:	Sylvester, N. D.
Performing Organization:	University of Tulsa, School of Engineering and Physical Science, 600 S. College Ave., Tulsa, OK 74110
Supporting Agency:	U.S. National Science Foundation, Division of Engineering. No. ENG76-02866.
Period:	2/77 to 1/78
Funds:	$21,250

This project is designed to evaluate experimentally the effects of several process variables on the oil-water separation efficiency of the induced-air flotation process, and to determine the mechanism of the process. Phase I of the program will study the effect of the following variables on the efficiency of the process: oil type and concentration, emulsion droplet size and distribution, emulsion flow rate and/or residence time, and air flow rate and bubble size. Phase II will investigate the effect of chemical flocculation on the flotation efficiency of the same emulsions studied in Phase I.

[SSIE No. GSE-5640-1]

R-143-76

NATIONAL ECONOMIC MODELS OF INDUSTRIAL WATER USE AND WASTE TREATMENT

Principal Investigator:	Thompson, R. G.
Performing Organization:	University of Houston, School of Business Administration, 3801 Cullen Blvd., Houston, TX 77004
Supporting Agency:	U.S. National Science Foundation, Division of Advanced Environmental Research and Technology. No. ENV72-03433 A05
Period:	7/74 to 8/75

This project is a continuation of an earlier project, the main objective of which was to develop production functions for the five most important water using industries (including the petroleum refining industry). The proposed project will refine, extend, and further verify the industrial models to permit evaluation of the effects of increasing scarcity of clean fuels on production costs, water use, air pollution, solid waste residuals, and brine disposal.

[SSIE No. GSQ-1497]

Status: The NSF (RANN) project was completed in December, 1975.

Reports and Publications

AN INTEGRATED INDUSTRY MODEL OF PETROLEUM REFINING, ELECTRIC POWER, AND CHEMICALS INDUSTRIES FOR COSTING POLLUTION CONTROL AND ESTIMATING ENERGY PRICES
Calloway, J. A., and R. G. Thompson. 1976.
Engineering and Process Economics Vol. 1:199-216.

Summary not available.

THE COST OF ENERGY: A LINEAR ECONOMIC MODEL OF THE PETROLEUM REFINING, ELECTRIC POWER, AND CHEMICALS INDUSTRIES
Thompson, R. G., J. A. Calloway, and L. A. Nawalanic (eds.). 1977.
Houston, Gulf Publishing Co., 1977.

Information Source: R. G. Thompson, University of Houston,
School of Business Administration, 3801
Cullen Blvd., Houston, TX 77004

R-010-77 (renewal)
OIL IN WATER TECHNOLOGY

Principal Investigator:	Venezky, D. L.
Performing Organization:	U.S. Navy, Research Laboratory, Washington, D. C. 20390
Supporting Agency:	U.S. Department of Defense, Navy. No. DN580168
Period:	10/76 to 9/77

In order to maintain naval expertise in the area of oil-in-water detection and assaying, the Naval Research Laboratory (NRL) will participate in reviewing and evaluating test methods which are submitted or proposed to the American Society for Testing and Materials, Committee D-19, and its task group on oil/grease in water. Oil and grease components will be identified, and methods will be developed to distinguish between soluble non-ionic and soluble ionic hydrocarbons in water. Resulting information will augment NRL's current efforts in oil/water separation technology.

[SSIE No. ZQN-580168-1]

R-049-77
PETROLEUM-CONCENTRATION AND REFINING: ENVIRONMENTAL

Principal Investigator:	Lifson, W. E.
Performing Organization:	Exxon Research and Engineering Company, P.O. Box 101, Florham Park, NJ 07932
Supporting Agency:	Exxon Corporation
Period:	7/75 to (continuing)

Project aims include research and development leading to novel processes and techniques that permit the refining of petroleum with minimal environmental degradation. Water treatment, air conservation, waste heat utilization, noise and odor control are among the areas of activity.

[SSIE No. CA-698-1]

R-050-77
U.S. NAVY OILY WASTE HANDLING PROGRAM: DEVELOPMENT OF LEGAL COST EFFECTIVE BULK FUEL STORAGE TANK STRIPPING SYSTEM

Principal Investigator:	Strandell, P. A., and J. W. Taylor
Performing Organization:	U.S. Navy, Ship Research and Development Center, Annapolis, MD 21402
Supporting Agency:	U.S. Department of Defense, Navy. No. DN778141.
Period:	10/76 to 9/77

The investigators propose to develop an automated system that will purge fuel storage tanks of water and dirt to Navy acceptable levels, separate oil from the effluent for reclamation and legally discharge the water and dirt to the environment in a cost-effective manner.

[SSIE No. ZQN-778141]

Reports and Publications

LIGHT SCATTERING TECHNIQUES FOR DISCRIMINATING BETWEEN OIL AND PARTICULATES IN CONTAMINATED WATER
Friedman, B. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p.153-156.
(American Petroleum Institute No. 4284)

Particulate matter interferes with the application of light scattering techniques used in several existing and proposed types of oil-in-water monitors. A mathematical analysis was made of the possibility of discriminating between oil and particulates by using measurements of the angular intensity distribution ot scattered light. It was found that, even with the determination of the state of polarization of the scattered light, a distinction of oil and particulates is difficult.

U.S. NAVY R&D EFFORTS IN SUPPORT OF OIL POLLUTION ABATEMENT STRATEGIES
Hura, M. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p.61-63.
(American Petroleum Institue No. 4284)

The basic strategy of the Navy's Oil Pollution Abatement program has been to institute measures that will reduce the amount of oil discharged from ships into the environment wherever possible before implementing oily waste treatment techniques. Navy laboratories have been instrumental in developing techniques and hardware to combat oil pollution. Contributions include shipboard oil/water separators, real-time oil-in-water monitors, and effluent oil spill containment and cleanup equipment.

NAVY DEVELOPMENT OF SUITABLE SHIPBOARD BILGE OIL/WATER SEPARATORS

Smookler, A. L., J. W. Harden, and P. D. Conroy. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 423-428.
(American Petroleum Institute No. 4284)

The development and evaluation of a Navy shipboard bilge oil-water separator are detailed and performance goals for effluent oil levels during in-port and at-sea periods are established. Test results on actual and deliberately contaminated bilge water are reported.

QUANTIFICATION OF NAVY OILS IN DETERGENT LADEN WATERS

Yu, T. S. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 169-172.
(American Petroleum Institute No. 4284)

The presence of detergents interferes with the solvent extraction and infrared spectrometry measurement technique for quantifying oil in water. This paper describes a study of an analytical method which utilizes silica gel to remove interfering detergent(s) in the extract so that infrared spectrometry can be used to quantify the oil in water. Silica gel can remove up to 96.5% of the interference, thus enabling the determination of oil in water in which the ratio of the concentration of detergent to oil is less than ten to one.

Information Source: J. M. Ford, Department of the Navy, Naval Ship Research and Development Center, Bethesda, MD 20084

5. RECLAMATION AND REUSE

R-051-77

MARKETING AND ENVIRONMENTAL BARRIERS TO REUSE OF WASTE LUBRICATING OIL

Principal Investigator: Liroff, S. D.
Performing Organization: Teknekron, Inc., 2118 Milvia St., Berkeley, CA 94704
Supporting Agency: U.S. National Science Foundation, Division of Advanced Environmental Research and Technology. No. ENV75-17302
Period: 3/76 to 9/77

The research is focused on strategies designed to reduce the technical, institutional, economic, and environmental barriers to reuse of waste lubricating oil. In Task I, a "Re-refining Profile" was developed which measured a government agency's ability to enter into a "closed-cycle" arrangement with a re-refiner. Task II involves a study of the conditions necessary for the participation of petroleum companies in the marketing of re-refined oil. Task III is a financial assessment of the re-refining industry, and Task IV is concerned with an economically and ecologically efficient method of disposing acid-sludge, which is a toxic residual of the predominant re-refining technology in use.

[SSIE No. GSQ-1488]

Status: The following publications will be available in September, 1977.

Reports and Publications

ECONOMICS OF RE-REFINING
Liroff, S. D., and M. A. Hoffman. Forthcoming.
Teknekron, Inc., Berkeley. CA.

REGIONAL GOVERNMENTS' PARTICIPATION IN WASTE OIL RECOVERY AND REUSE
Liroff, S. D., and M. A. Hoffman. Forthcoming.
Teknekron, Inc., Berkeley, CA.

MAJOR PETROLEUM COMPANIES - PARTICIPATION IN WASTE OIL RECOVERY AND REUSE
Liroff, S. D., and M. A. Hoffman. Forthcoming.
Teknekron, Inc., Berkeley, CA.

THE MANAGEMENT OF ACID SLUDGE
Sessler, G. Forthcoming.
Teknekron, Inc., Berkeley, CA.

Information Source: S. D. Liroff, Teknekron, Inc., 2118 Milvia St., Berkeley, CA 94704

6. PREVENTION AND CONTROL MEASURES

R-052-77
OIL POLLUTION CONTROL AT MILITARY INSTALLATIONS

Principal Investigator: Fileccia, R. J.
Performing Organization: U.S. Army, Constr. Engineering Research Lab., P.O. Box 4005, Champaign, IL 61820
Supporting Agency: U.S. Department of Defense, Army. No. DAOS8126
Period: 10/76 to 9/77

Several Class I installations will be surveyed to determine the cause, magnitude, and chemical nature of oily discharges from facility operations. Based on the findings of the survey, recommendations for minimizing, treating, or eliminating these waste discharges will be formulated for demonstration in the field.

[SSIE No. ZQA-198126]

R-053-77
DETERMINATION OF QUANTITIES OF CERTAIN FUELS, OILS, AND TARS IN STORM RUNOFF WATERS FROM HIGHWAYS

Principal Investigators: Malina, J. F., and B. L. Wiland
Performing Organization: University of Texas, School of Engineering, 200 W. 21st St., Austin TX 78712
Supporting Agency: U.S. Department of Transportation, Federal Highway Administration
Period: 7/75 to 6/76

The presence or absence of certain categories of fuels, oils, and tars in storm runoffs from Texas highways was determined. Variations of specific and related components washed from asphalt and concrete pavements were monitored seasonally for one annual cycle. These research findings have been used to identify and isolate the contribution to water pollution resulting from storm water runoff from highway pavements and to develop suitable control strategies and pollution abatement measures.

[SSIE No. GZD-171]

Status: The project has been completed and the final report is currently being prepared.

Information Source: J. F. Malina, Jr., Department of Civil Engineering, University of Texas, 200 W. 21st, Austin, TX 78712

R-054-77
ENVIRONMENT CONSERVATION
Principal Investigator: McReynolds, L. A.
Performing Organization: Phillips Petroleum Company, Bartlesville, OK 74004
Supporting Agency: Phillips Petroleum Company
Period: 10/76 to 9/77

Environmental efforts include process studies to develop improved gasoline fractions to produce unleaded gasoline; work on desulfurization of energy producing products derived from fossil fuels; improved methods to minimize air and water pollutants in discharges from refineries, processing plants, transportation facilities, and service station dispensing units; and studies to improve fuel and lubricant products to help meet future emission requirements.

[SSIE No. BI-110690]

Reports and Publications

A MULTIPARAMETER OIL POLLUTION SOURCE IDENTIFICATION SYSTEM
Miller, J. W. 1973.
Report EPA-R2-73-221, Contract No. 68-01-0059.

Summary not available.

Information Source: L. A. McReynolds, Phillips Petroleum Company, Bartlesville, OK 74004

R-055-77
ENGINEERS SCRUTINIZE POLLUTION IN TEXAS SHIP CHANNELS, HARBORS
Principal Investigators: Withers, R. E., and M. Reavis
Performing Organization: Texas A&M University, Department of Civil Engineering, College Station, TX 77843
Supporting Agency: U.S. Department of Commerce, National Oceanic and Atmospheric Administration
Period: 9/75 to 9/77

University engineers are studying the pollution problems of Texas ship channel-harbor complexes and are preparing a comprehensive report to help port directors identify and correct pollution sources. The first part of the report will identify and classify sources of water pollution within each channel-harbor complex and assess the quality, quantity, and frequency of pollution by each source. Thirteen different sources have been examined and ranked. The second part of the study will describe the problems of port management and suggest approaches to solving them.

[MRIS Abstracts 14:#14 129695. 1976]

C. EFFECTS OF OIL POLLUTION

1. BIOLOGICAL EFFECTS

R-292-75 (renewal)
PHYSIOLOGY AND BIOASSAY STUDIES, ALASKA
Principal Investigator: Karinen, J. F.
Performing Organization: U.S. Department of Commerce, Auke Bay Fisheries Laboratory, P. O. Box 155, Auke Bay, AK 99821
Supporting Agency: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. No. ABL00776E1A1
Period: 7/75 to 7/76
Funds: $168,000

Major task objectives are: to identify deleterious effects and evaluate the potential danger of chronic exposure of marine organisms to Alaska crude oil, to use these responses as means for monitoring and detecting, to evaluate the effects of oil under various temperature and salinity regimes, and to determine the ability of organisms to successfully adapt to oil pollution.

[SSIE No. ZBP-969-1]

Status: Static 96-hr acute bioassays are being phased out and longer term flow-through tests are being conducted to achieve research objectives. Greater emphasis is also being placed on sublethal effects, determining the toxicity of various petroleum components and temperature effects on oil toxicity.

Two general conclusions have been drawn from research to date: crustacean larvae have been found to be the most sensitive life stage, especially when molting; and Alaskan species may be more vulnerable to oil than species from warmer waters, since colder temperatures cause toxic aromatics to persist longer. Temperature effects on oil toxicity and animal sensitivity are complex and warrant further study.

Reports and Publications

SENSITIVITY OF LARVAL AND ADULT ALASKAN SHRIMP AND CRABS TO ACUTE EXPOSURES OF THE WATER-SOLUBLE FRACTION OF COOK INLET CRUDE OIL
Broderson, C. C., S. D. Rice, J. W. Short, T. A. Mecklenburg, and J. F. Karinen. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 575-578. (American Petroleum Institute No. 4284)

Tests using 96-hour static bioassays at water temperatures normally encountered by the organisms were conducted in the title study. Larvae were found to be more sensitive to oil than adults, and the sensitivity of the larvae was dependent on species and developmental stage. Greater vulnerability of larvae to oil exposure is probably due to greater susceptibility to oil toxicity and predation. Cold water species are particularly vulnerable because of the long time spent as developing larvae.

EFFECTS OF OIL ON MARINE ECOSYSTEMS: A REVIEW FOR ADMINISTRATORS AND POLICY MAKERS
Evans, D. P., and S. D. Rice. 1974.
U.S. National Marine Fisheries Service Bulletin 72(3):625-638.

"A review of selected literature [is] surveyed for the marine section of the Environmental Impact Statement for the proposed Trans-Alaska pipeline project, emphasizing the need for research on the effects of chronic low level pollution."

EFFECTS OF PRUDHOE BAY CRUDE OIL ON MOLTING TANNER CRABS, CHINONOECETES BAIRDI
Karinen, J. F., and S. D. Rice. 1974.
Marine Fisheries Review 36(7):31-37.

Static bioassays using Prudhoe Bay crude oil and juvenile male Tanner crabs were performed. Both pre- and postmolt crabs were susceptible to oil, with the 48-hr TL_m being 0.58 ml oil/l. The oil affected molting success and caused newly molted crabs to autotomize limbs. Alaska's Tanner crab resources would be adversely affected by oil spills.

EFFECTS OF LOW TEMPERATURE ON THE SURVIVAL OF PINK SALMON AND SHRIMP EXPOSED TO TOLUENE, NAPHTHALENE, AND THE WATER-SOLUBLE FRACTION OF COOK INLET CRUDE OIL.
Korn, S., D. A. Moles, and S. D. Rice. Submitted.

The effect of different temperatures on the toxicity of the title compounds depended on species and toxicant. Survival of shrimp exposed to toluene and naphthalene was significantly less at higher temperatures. In contrast, survival of pink salmon exposed to toluene was significantly less at lower temperatures. Other tests did not yield significant temperature effects.

HEART RATES IN ALASKAN KING CRAB, *PARALITHODES CAMTSCHATICA*, EXPOSED TO COOK INLET CRUDE OIL, BENZENE, AND NAPHTHALENE

Mecklenburg, T. A., and S. D. Rice. Submitted.

The heart rate declined during the first hours of exposure, then returned to control or near-control rates as the crude oil, benzene, or naphthalene concentrations in the test waters declined. The severity of heart rate depression in the crude oil experiments was correlated with the initial concentration of aromatic hydrocarbons. Recovery was dependent on degradation of the toxicants.

MOLTING AND SURVIVAL OF KING CRAB (*PARALITHODES CAMTSCHATICA*) AND COONSTRIPE SHRIMP (*PANDALUS HYPSINOTUS*) LARVAE EXPOSED TO COOK INLET CRUDE OIL WATER-SOLUBLE FRACTION

Mecklenburg, T. A., S. D. Rice, and J. F. Karinen. 1977.
NOAA-EPA Symposium on Fate and Effects of Petroleum Hydrocarbons, Seattle, 1976. In press.

Molting larvae were more sensitive than intermolt larvae to the water-soluble fraction (WSF) of crude oil, and molting coonstripe shrimp larvae were more sensitive than molting king crab larvae. When molting larvae were exposed to high concentrations of the WSF (1.15-1.87 ppm total hydrocarbons) for six hours, molting success was reduced by 10-30% and some deaths occurred. When larvae were exposed to these concentrations for 24 hours or longer, molting declined 90-100% and the larvae usually died. Comparisons of sensitivity to oil between different crustacean species or life stages should be based on animals tested in the same stage of the molt cycle.

THE EFFECT OF PRUDHOE BAY CRUDE OIL ON SURVIVAL AND GROWTH OF EGGS, ALEVINS, AND FRY OF PINK SALMON, *ONCORHYNCHUS GORBUSCHA*

Rice, S. D. 1975.
Conference on Prevention and Control of Oil Pollution, San Francisco, 1975.

Eggs of the pink salmon were the most resistant to oil solutions and emergent fry the most sensitive to acute 4-day exposures. In freshwater, the 96-hour median tolerance limit (TL_m) of fry was 0.4 ml oil/l, and in seawater it was 0.04 ml oil/l. Growth was affected most severely in alevins exposed during later developmental stages. In freshwater, susceptibility of early life history stages of pink salmon to oil pollution is great at the time of emergence (completion of yolk absorption). Susceptibility is even greater in seawater after fry migration.

TOXICITY AND AVOIDANCE TESTS WITH PRUDHOE BAY OIL AND PINK SALMON FRY

Rice, S. D. 1973.
Joint Conference on Prevention and Control of Oil Spills, Washington, D.C., 1973.

Observed 96-hour TL_m values for the pink salmon fry were 88 mg of oil/l of water in freshwater and 213 mg/l in seawater in June and 110 mg/l in seawater in August. Old fry were more susceptible to oil toxicity in seawater than younger fry; older fry were also more sensitive in their detection and avoidance of oil. Avoidance of oil by salmon fry was quite apparent and suggests that there is potential for oil pollution to change their migration behavior.

ACUTE TOXICITY AND UPTAKE-DEPURATION STUDIES WITH COOK INLET CRUDE OIL, PRUDHOE BAY CRUDE OIL, NO. 2 FUEL OIL AND SEVERAL SUBARCTIC MARINE ORGANISMS

Rice, S. D., J. W. Short, C. C. Brodersen, T. A. Mecklenburg, D. A. Moles, C. J. Misch, D. L. Cheatham, and J. F. Karinen. 1976.
Northwest Fisheries Center Auke Bay Fisheries Laboratory, Processed report. 90 p.

This report provides the results of a laboratory study of which the primary objectives were: to determine the acute toxicity of Cook Inlet and Prudhoe Bay crude oils and fuel oil to various life stages and species of fish and shellfish found in Kachemak Bay; to determine the rate and degree of uptake and depuration of hydrocarbons by these organisms when they are exposed to sublethal concentrations of the water-soluble fractions (WSF) of Cook Inlet crude oil; and to compare results to published literature to determine to what degree Alaskan fish and shellfish differ from species in other areas in their response to oil contamination.

A REVIEW OF COMPARATIVE OIL TOXICITY AND COMPARATIVE ANIMAL SENSITIVITY

Rice, S. D., J. W. Short, and J. F. Karinen. 1977.
NOAA-EPA Symposium on Fate and Effects of Petroleum Hydrocarbons, Seattle, 1976. In press.

This review includes studies dealing with the ability of crude and refined oils to kill marine animals and covers: (1) the behavior of oil in water; (2) the methodology problems associated with bioassays; (3) the comparative toxicity of oil-water mixtures, oils, and components of oils; and (4) the comparative sensitivity of different life stages and species. Emphasis is on methods, comparative toxicity, and comparative sensitivy with conclusions and recommendations for future research.

TOXICITY OF COOK INLET CRUDE OIL AND NO. 2 FUEL OIL TO SEVERAL ALASKAN MARINE FISHES AND INVERTEBRATES
Rice, S. D., J. W. Short, and J. F. Karinen. 1976.
Sources, Effects & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 394-406.
Proceedings of the Symposium, American University, Washington, D. C., 9-11 August 1976.

Crude oil, Fuel oil, Toxicity, Marine organisms, Alaska, Fish, Invertebrates, Intertidal zone

Median tolerance levels of 27 different marine Alaskan invertebrate and vertebrate species to water soluble fractions of crude oil and No. 2 fuel oil were determined using a 96-hour static bioassay method. The two oils were equally toxic, fish were consistently among the most sensitive species, and intertidal invertebrates were consistently among the most resistant species. Alaskan marine species appear to be slightly more sensitive than those of temperate regions; this difference in sensitivity may be due to the greater persistence of toxic hydrocarbons at the lower temperatures.

EFFECT OF PETROLEUM HYDROCARBONS ON BREATHING AND COUGHING RATES AND HYDROCARBON UPTAKE-DEPURATION IN PINK SALMON FRY
Rice, S. D., R. E. Thomas, and J. W. Short. 1977.
Physiological Responses of Marine Biota to Pollutants.
New York, Academic Press, 1977.

Breathing and coughing rates of pink salmon fry, Oncorhynchus gorbuscha, were monitored during exposure to water soluble fractions of Cook Inlet and Prudhoe Bay crude oils and No. 2 fuel oil. High breathing rates during the first 24 hrs of exposure, elimination of most aromatics by 20 hrs, and the continued high breathing during a contact dose exposure for 72 hrs indicate that salmon fry can cope with a sublethal exposure to hydrocarbons, but at the cost of an increased metabolic rate. Increased metabolic rates may be detrimental to survival if the stress persists for long periods of time.

ACCUMULATION, RETENTION, AND DEPURATION OF PETROLEUM-DERIVED HYDROCARBONS BY FOUR SPECIES OF ALASKAN ANIMALS (SCALLOPS, SHRIMP, KING CRAB, AND SALMON)

Short, J. W., and S. D. Rice. 1977.
Fishery Bulletin. In press.

Water-soluble fraction (WSF) derived n-paraffins of Cook Inlet crude oil were accumulated by scallops and pink salmon fry gill tissue when exposed at 4°-8°C for 4 or 5 days. The source of n-paraffins found in the other animals was unclear. Depuration of accumulated n-paraffins was rapid when these organisms were returned to clean seawater. Aromatics were immediately and rapidly absorbed by all species except king crab which rapidly absorbed aromatics after a 10-hour delay period. Aromatics were rapidly depurated by pink salmon fry before their return to clean seawater, and by king crab right after their return to clear water. Depuration by scallops and shrimp in clear seawater was initially rapid but then slowed. It was concluded that temperature has only a minor effect on the accumulation and depuration of aromatic hydrocarbons.

COMPARISON OF TWO METHODS FOR OIL AND GREASE DETERMINATION

Short, J. W., S. D. Rice, and D. L. Cheatham. 1976.
Assessment of the Arctic Marine Environment: Selected Topics. Fairbanks, Institute of Marine Science, University of Alaska, 1976. Chapter 28. p. 451-462.

The authors compare oil content measured by the gravimetric method (which is used by government agencies for determining levels of oil in discharge waters) with oil content determined by infrared spectrophotometry for toxic water-soluble fractions of two crude oils and a fuel oil. Recovery of all the oils and a synthetic grease standard was 100% by the infrared method. Using the gravimetric method, recovery of the grease standard was 98%, but recovery of the three pure oils ranged from 52 to 65%. It is concluded that the gravimetric method is sensitive to heavier compounds of the oils. When oil concentrations in water are to be measured and correlated with chemical toxicity, the gravimetric procedure should be supplemented with a method specific for the more soluble and volatile components.

RESPONSE OF THE CLAM, MACOMA BALTHICA (LINNAEUS), EXPOSED TO PRUDHOE BAY CRUDE OIL AS UNMIXED OIL, WATER-SOLUBLE FRACTION, AND OIL-CONTAMINATED SEDIMENT IN THE LABORATORY
Taylor, T. L., and J. F. Karinen. 1977.
NOAA-EPA Symposium on Fate and Effects of Petroleum Hydrocarbons, Seattle, 1976. In press.

Gentle settling of crude oil over clam beds had negligible effects on clams observed for two months. Water-soluble (WSF) and oil-treated (OTF) sediment fractions of Prudhoe Bay crude oil inhibitied burrowing and caused clams to move to the sediment surface. Responses were directly proportional to the concentrations of the WSF or amount of OTF. The significance of these laboratory tests to survival of M. balthica in the natural environment is discussed.

INCREASED OPERCULAR RATES OF PINK SALMON (ONCORHYNCHUS GORBUSCHA) FRY AFTER EXPOSURE TO THE WATER-SOLUBLE FRACTION OF PRUDHOE BAY CRUDE OIL
Thomas, R. E., and S. D. Rice. 1975.
Journal of the Fisheries Research Board of Canada 32(11): 2221-2224.

The opercular rates of the pink salmon increased significantly for 9 to 12 hours after exposure to water-soluble fractions of oil-water solutions. Increases in rates were proportional to increases in dose. Recording changes in opercular rates is a suitable method for detecting sublethal physiological effects of stress.

Information source: J. F. Karinen, U.S. Department of Commerce,
Auke Bay Fisheries Laboratory, P. O. Box
155, Auke Bay, AK 99821

R-098-76 (renewal)
CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT (CEPEX) - ZOOPLANKTON POPULATION ASSESSMENT
Principal Investigator: Grice, G. D.
Performing Organization: Woods Hole Oceanographic Institution, Main St., Woods Hole, MA 02543
Supporting Agency: U.S. National Science Foundation, Division of Ocean Sciences. No. OCE76-80249
Period: 1/77 to 2/78
Funds: $63,000

In the CEPEX, scientists from the United States, United Kingdom, and Canada are studying the effects of specific pollutants on oceanic communities. In the proposed research, zooplankton contained in large plastic cylinders are subjected to low-level and long-term exposure to petroleum and heavy metals. The results will permit assessment of the impact of known levels of pollutants on zooplankton species, occurrence, abundance, and life history.

[SSIE No. GSN-1507-3]

R-100-76 (renewal)
PHYSIOLOGICAL EFFECTS OF CONTAMINANTS
Principal Investigator: Malins, D. C.
Performing Organization: U.S. Department of Commerce, Environmental Conservation Division, 2725 Montlake Blvd. E., Seattle, WA 98112
Supporting Agency: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service No. NWC03376EIA1
Period: 7/75 to 6/76
Funds: $287,300

On-site research has been conducted at three strategically located field facilities to investigate the stress and behavioral effects of contaminants and alterations on the survival of salmonid stocks in the lower Columbia River and selected species in Puget Sound. Data are provided on effects of nitrogen, dredge disposal, petroleum, and temperature to improve water quality standards, an adequate review on intake and discharge permits, and environmental impact statements.

[SSIE No. ZBP-945-1]

Reports and Publications

INDUCTION OF HEPATIC ARYL HYDROCARBON HYDROXYLASE IN SALMON EXPOSED TO PETROLEUM DISSOLVED IN SEAWATER AND TO PETROLEUM AND POLYCHLORINATED BIPHENYLS, SEPARATE AND TOGETHER, IN FOOD
Gruger, E. H., Jr., M. M. Wekell, P. T. Numoto, and D. R. Craddock. 1977.
Bulletin of Environmental Contamination and Toxicology

Hepatic aryl hydrocarbon hydroxylase (AHH) is induced in coho salmon exposed to 1 ppm PCB's in the diet; however, comparable experiments with 1 ppm Prudhoe Bay crude oil did not alter the AHH activities. These findings suggest that in aquatic food chains containing petroleum hydrocarbons and PCB'S, the latter substance may exert a predominant influence on the induction of the hepatic AHH enzyme system. Young coho salmon exposed to 150 ppb of a seawater-soluble fraction of crude oil for 6 days exhibited a significant induction of this enzyme system. Thus, highly soluble crude oil components may be more effective than high molecular weight insoluble components in inducing AHH.

EFFECTS OF CHLORINATED BIPHENYLS AND PETROLEUM HYDROCARBONS ON THE ACTIVITY OF HEPATIC ARYL HYDROCARBON HYDROXYLASE OF COHO SALMON (ONCORHYNCHUS KISUTCH) AND CHINOOK SALMON (O. TSHAWYTSCHA)

Gruger, E. H., Jr., M. M. Wekell, and P. A. Robisch.
Unpublished report.

Saltwater-adapted coho and chinook salmon were fed mixtures of test compounds; one composed of chlorobiphenyls and the other of petroleum hydrocarbons. Induction of aryl hydrocarbon hydroxylase (AHH) activity occurred in hepatic microsomes from coho salmon within the first two weeks of hydrocarbon exposure. Induction was potentiated by the presence of chlorobiphenyls; however, no effect on enzyme activity was found with chlorobiphenyls alone. In chinook salmon, AHH activity in hepatic microsomes was depressed by the chlorobiphenyls and hydrocarbons, administered both separately and together. The results provide evidence indicating that aryl hydrocarbon (benzo-[a]pyrene) hydroxylase responds differently in different species of salmonids to chlorobiphenyls and petroleum hydrocarbons in food.

EFFECTS OF PETROLEUM ON ARCTIC AND SUBARCTIC MARINE ENVIRONMENTS AND ORGANISMS

Malins, D. C. 1977.
New York, Academic Press, 1977. Vol. II. Biological Effects of Petroleum.

The impacts of petroleum hydrocarbons on the biota of pristine areas is poorly understood, despite certain relevant data from laboratory experiments with indigenous organisms and a lesser amount of field information. In this volume an attempt is made to compile data on the biological effects of petroleum on marine organisms, evaluate the implications to possible alterations in organisms and ecosystems, and offer suggestions for future work where significant gaps in knowledge exist.

Information Source: D. C. Malins, U.S. Department of Commerce,
Environmental Conservation Division, 2725
Montlake Blvd., E., Seattle, WA 98112

R-056-77

MACROBENTHIC SURVEY IN THE VICINITY OF THE METULA OIL SPILL, MAGELLAN STRAIT, CHILE

Principal Investigators: Gallardo, V. A., J. G. Castillo, R. C. Swartz, and D. J. Baumgartner
Performing Organization: University of Concepción, Casilla 1367, Concepción, Chile
Supporting Agency: U.S. Environmental Protection Agency, Office of Research and Development. No. R804514 01
Period: 4/76 to 6/77
Funds: $47,350

Project objectives are: to quantitatively describe the faunal composition, density, standing crop, diversity, dominance and spatial homogeneity of the subtidal macrobenthos of Bahia Felipe, the site of the "Metula" spill; and to correlate changes in the community structure with depth, bottom water quality, and sediment characteristics, especially oil pollution, particle size distribution,and organic carbon content. The survey will be performed on board "E/V HERO". A sampling grid has been designed to observe the impact of oil from the source of the spill and the areas where it was finally deposited.

[SSIE No. GMA-3243]

R-057-77

DETECTION OF CARCINOGENICITY OF OILS IN SEAWATER - USE OF HYBRID FISH AND FOOD CHAIN

Principal Investigators: Humm, D. G., M. L. Bellamy, and C. F. Smith
Performing Organization: University of North Carolina, School of Arts and Sciences, Chapel Hill, N.C. 27514
Supporting Agency: U.S. Environmental Protection Agency, Office of Research and Development. No. R804650 01
Period: 9/76 to 8/77
Funds: $41,150

Effects are being made to apply a sensitized fish bioassay to the detection and measurement of carcinogens in shale oil, crude oil, and seawater pollution, and to develop an artificial laboratory food chain and measure the quantitative transfer and destruction of carcinogens in their passage along the chain.

[SSIE No. GMA-3269]

R-058-77

SUBLETHAL BIOCHEMICAL EFFECTS OF CONTAMINANTS

Principal Investigator: Malins, D. C.
Performing Organization: U.S. Department of Commerce, Environmental Conservation Division, 2725 Montlake Blvd. E., Seattle, WA 98112
Supporting Agency: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. No. NWC03176EIA1
Period: 7/75 to 7/76
Funds: $313,400

Emphasis is placed on definition of the magnitude of impact on marine biota from steady low-level introduction of components of petroleum oil into the marine environment. Determinations will be made on effects of aromatic hydrocarbons, metals, and petroleum oil fractions on larval, juvenile, and adult forms of fish and crustacea under various environmental conditions such as temperature and salinity.

[SSIE No. ZBP-916-1]

For reports and publications, see R-100-76, p. 259.

R-059-77

EFFECTS OF PETROLEUM COMPOUNDS ON ESTUARINE FISHES

Principal Investigators: Martin, B. J., and H. D. Howse
Performing Organization: University of Southern Mississippi, School of Science and Technology, Hattiesburg, MS 39401
Supporting Agency: U.S. Environmental Protection Agency, Office of Research and Development. No. R804527 01
Period: 7/76 to 10/77
Funds: $85,669

The purpose of this project is to study chemically induced tumors in teleost fishes. Tissues from the liver, kidney, intestine, and gills of fish exposed to low levels of a known carcinogen will be studied histologically. This research will provide data concerning the quantities of benzopyrene necessary to induce neoplasias, establish the feasibility of using teleost fish as early indicators of carcinogenic substances in the aquatic environment, and demonstrate the cost effectiveness of this type system.

[SSIE No. GMA-3065]

R-060-77

PHYSIOLOGICAL ECOLOGY AND THE EFFECTS OF CRUDE OILS ON ARCTIC MARINE INVERTEBRATES TO INCLUDE ADDITIONAL RELATED STUDIES

Principal Investigator:	Mullin, T. C.
Performing Organization:	Unknown institute or individual grant, Canada
Supporting Agency:	Canada, Department of the Environment. No. OSX4-0046
Period:	7/75 to 6/76
Funds:	$6,236

No summary provided to SSIE.

[SSIE No. WDB-23]

R-061-77

FATE AND EFFECTS OF PETROLEUM HYDROCARBONS AND SELECTED TOXIC METALS IN SELECTED MARINE ECOSYSTEMS AND ORGANISMS

Principal Investigator:	Wolfe, D. A.
Performing Organization:	U.S. Department of Commerce, Environmental Research Labs, Boulder, CO 80302
Supporting Agency:	U.S. Environmental Protection Agency, Office of Research and Development. No. EPA-IAG-D6-E693-EM
Period:	8/75 to 7/76
Funds:	$478,000

The project includes four tasks with the following objectives: establish an NOAA analytical capability for petroleum hydrocarbons and toxic metals in the marine environment for purposes of standardizing analytical techniques and providing intercalibration services; design a comprehensive program of lab and field research to fill information gaps with reference to a particular study site in a coastal portion of the northeast Gulf of Alaska; select and conduct specific laboratory experiments on fate and effects of metals and hydrocarbons, and conduct controlled experimental ecosystem research to test the ability to predict ecological and biological impacts of petroleum in subarctic ecosystems.

Equipment has been purchased and routine analyses of petroleum hydrocarbons in environmental samples are underway at the NOAA National Marine Fisheries Service, Northwest Fisheries Center, Seattle, WA. Laboratory experiments are being conducted to examine the interactions between PCB's and petroleum hydrocarbons in juvenile salmon and to determine the effects of petroleum on trace metal distributions between sediments and seawater. Feasibility studies and experimental design are underway.

[SSIE No. GMA-3038]

2. GENERAL EFFECTS

R-062-77

SEDIMENTARY PROCESSES AND SEDIMENTS, BABBAGE RIVER DELTA, YUKON COAST

Principal Investigator: Forbes, D. L.
Performing Organization: Canadian Department of Energy and Resources, Terrain Sciences Division, 601 Booth St., Ottawa, Ontario, KIA 038, Canada
Supporting Agency: Canada Department of Energy, Mines and Resources, Geological Survey of Canada
Period: 4/76 to 3/77

The investigator proposes to develop integrated sedimentation models applicable to an estuarine delta in a tundra and permafrost environment, consider the stability of the system and its potential response to artificial changes resulting from pipeline construction or oil spills, and consider the use of the Babbage River delta as a small scale research analog for the Mackenzie delta.

[SSIE No. CM-226]

R-063-77

THE FEASIBILITY OF EXTENDING SOCIO-ECONOMIC ENERGY STUDIES WITH MEASUREMENTS OF ENVIRONMENTAL EFFECTS

Principal Investigator: Lundin, A.
Performing Organization: University of Stockholm, Box 6409, Fack S-104 05, Stockholm 50, Sweden
Supporting Agency: Sweden Energy Research and Development Commission
Period: 1/76 to 3/77
Funds: $29,200

A survey is being made of the methodology and results of studies which have attempted to measure environmental effects, especially air and water pollution, resulting from oil refining and transportation, production of electrical power, and use of energy in processing industries. The results of the survey are planned to be reported in March, 1977.

[SSIE No. CM-124]

D. EFFECTS OF OIL PROSPECTING AND PRODUCTION

1. BIOLOGICAL EFFECTS

R-064-77
MITIGATION GOALS FOR OIL SHALE

Principal Investigator:	Unknown
Performing Organization:	Colorado State University, State Cooperative Wildlife Research Unit, Fort Collins, CO 80523
Supporting Agency:	U.S. Department of the Interior, Fish and Wildlife Service, Wildlife Research Division. Contract Welut No. 051-75
Period:	11/75 to 10/76

This study will identify the most significant fish and wildlife population reductions that will result from environmental changes caused by oil shale development, formulate a list of candidate mitigation goal alternatives, and evaluate the effectiveness of a sample of previous attempts to mitigate wildlife population reductions. No collection of quantitative data in the field is anticipated.

[SSIE No. GU-144]

Status: This project is approximately 60% complete and is scheduled for completion by November, 1978. No papers have yet been prepared. The principal product of the contract will be a series of computer programs and data banks.

Information source: K. R. Russell, Colorado State University,
State Cooperative Wildlife Research Unit,
Fort Collins, CO 80523

R-065-77
ANALYSIS OF OUTER CONTINENTAL SHELF DEVELOPMENT AND POTENTIAL IMPACTS ON MARINE MAMMAL POPULATIONS

Principal Investigator:	Waring, G. H.
Performing Organization:	Unknown institute or individual grant, Virginia
Supporting Agency:	U.S. Marine Mammal Commission. Contract MM6AC012
Period:	1/76 to 9/76
Funds:	$19,040

The objectives of the study are to identify the marine mammal populations that could be impacted by present and proposed OCS oil and gas development activities, evaluate for each proposed sale area the potential impact on marine stocks, assess the completeness of the present marine mammal data base in potentially high impact areas and recommend additional studies necessary for impact evaluation, identify the safeguards proposed and taken by government and industry to minimize these impacts, and recommend alternative courses of action that will minimize the potential or realized threat to marine mammal populations.

[SSIE No. CH-589]

2. GENERAL EFFECTS

R-066-77

ENVIRONMENTAL ASSESSMENT OF AN ACTIVE OIL FIELD IN THE NORTHWESTERN GULF OF MEXICO 1975-1980

Principal Investigators:	Angelovic, J. W., R. J. Berry, K. N. Baxter, J. H. Finucane, and W. L. Trent
Performing Organization:	U.S. Department of Commerce, Gulf Coastal Fisheries Center, 4700 Ave. U, Galveston, TX 77550
Supporting Agency:	U.S. Environmental Protection Agency, Office of Research and Development. No. IAG-D6-E693-EO
Period:	7/75 to 6/76

A detailed five-year environmental assessment study of the Buccaneer oil and gas field was initiated in April, 1976. The objectives are to describe existing ecosystems and areal distribution of their major components, compare concentrations of pollutants in the sediments, water, and biota of the oil field to those in an unaltered area, and identify changes that have occurred. Surveys have been initiated to describe the hydrography, water quality parameters, sediments, pollutants, and the abundance, distribution, diversity and habitat of major planktonic, benthic, and pelagic communities.

[SSIE No. GMA-2928]

Status: The final report for the first year's work should be available for distribution by NOAA/EPA in August, 1977. Investigators are in the process of initiating the second year's work.

The summaries listed below give results for the period November, 1975, through April, 1977.

Reports and Publications

ENVIRONMENTAL ASSESSMENT OF AN ACTIVE OIL FIELD IN THE NORTHWESTERN GULF OF MEXICO, 1975-1977

Task 2.3 Alterations and Marine Ecosystems

SUMMARY OF RESULTS - WORK UNITS 2.3.2 AND 2.4.2. SEDIMENTS AND TRACE METALS
Anderson, J. B., R. R. Schwarzer, and H. C. Clark

Geological and geochemical studies were conducted as part of an environmental assessment of the Buccaneer offshore Texas oil/gas field. Included were seismic profile studies to elucidate the geologic structure of the area, sediment sampling to determine size distributions, textures and mineralogy, and trace metal analyses of sediments near platforms to understand types and sources of contamination.

SUMMARY OF RESULTS - WORK UNIT 2.3.3. BENTHOS
Harper, D., Jr.

As part of an environmental assessment of the Buccaneer offshore Texas oil/gas field, studies were conducted on benthic organisms around platforms, and on seasonal population variations. The substrate in this region ranges from sandy mud to muddy sand and the residing benthic organisms are primarily crustaceans and polychaete worms.

SUMMARY OF RESULTS - WORK UNIT 2.3.4. DEMERSAL FINFISH AND MACRO-CRUSTACEANS
Emiliani, D.

Several sampling cruises were conducted in the Buccaneer offshore oil/gas field to compare population densities of the title organisms in platform areas and in control areas. The largest number of species and the largest catch, based on number per hour of all species caught, were from the platform areas.

SUMMARY OF RESULTS - WORK UNIT 2.3.5. PELAGIC AND REEF FISHES
Trent, L.

Recreational fishing studies were conducted as a part of an environmental assessment of the Buccaneer offshore Texas oil/gas field. Number of species caught and number of fishing boats in the oil field area were monitored for diurnal and seasonal variations.

SUMMARY OF RESULTS - WORK UNIT 2.3.6. ICHTHYOPLANKTON
Finucane, J. H.

Ichthyoplankton studies conducted in the Buccaneer offshore oil/gas field area and adjacent coastal waters revealed that total species diversity was greater in the oil field area than in the control area. During spawning seasons, the oil field areas were found to contain a greater number of eggs and larvae than control stations. Oil platforms and related structures appear to serve as artificial reefs that attract fish and other organisms.

SUMMARY OF RESULTS - WORK UNIT 2.3.8. EFFECTS OF STRUCTURES
Fotheringham, N.

The interactions between production platforms and the community of fouling organisms, its plantonic larvae, and its predators were studied as part of an environmental assessment of the Buccaneer offshore oil/gas field. Sixteen algal species and 101 invertebrate species were found to encrust the structure, and 27 species of resident fishes were enumerated. The benthic fauna directly below the structure were enriched by food resources dropping from the platform-encrusting organisms.

SUMMARY OF RESULTS - WORK UNIT 2.3.8. EFFECTS OF STRUCTURES - AVIAN POPULATIONS
Aumann, G.

The effects of a platform on migrating and resident birds were studied. Effects on migrating marine birds were judged to be negligible. Resident marine birds were found to benefit from the structure's presence and the effects on migrating land birds were assessed as possibly, but not conclusively, detrimental.

SUMMARY OF RESULTS - WORK UNIT 2.3.9. CURRENTS, TEMPERATURES, AND SALINITIES
Martin, J.

As a part of an environmental assessment of the Buccaneer offshore Texas oil/gas field, seasonal variations in salinities, temperatures, and current patterns in the oil field area were monitored for one year. Results are presented.

SUMMARY OF RESULTS - WORK UNIT 2.4.1. HYDROCARBONS
Middleditch, B.

The types and concentrations of hydrocarbons in Buccaneer oil field crude oils, condensates, discharged formation waters, seawater, marine invertebrates and vertebrates, and sediments were determined. The crude oil contains 18% n-alkanes, together with branched alkanes and aromatic hydrocarbons. Condensates were relatively enriched with volatile components. Low levels of petroleum alkane contamination were present in surface-seawater samples and in near-surface organisms, i.e. barnacles. Only one of four species of shrimp examined contained petroleum alkanes. Inconclusive results were obtained for plankton; no petroleum was found in squid or sediments.

SUMMARY OF RESULTS - WORK UNIT 2.4.3. TOTAL ORGANICS C^{13}/C^{12}
Behrens, W.

The extent of pollution of total organic carbon in recent marine sediments of the Buccaneer oil/gas field was compared to an unaltered area by measuring the carbon isotope characteristics of the total organic carbon present. Results show a pattern of anomalously old radiocarbon ages in sediments of the oil field and in surrounding areas, indicating that pollution from oil production has occurred. However, the carbon isotope distribution pattern does not fit a simple test model.

Information source: E. F. Klima, U.S. Department of Commerce,
National Marine Fisheries Service, SEFC,
Galveston Laboratory, 4700 Ave. U,
Galveston, TX 77550

R-067-77
IMPACT OF ENVIRONMENTAL CHANGE, MIDDLE ATLANTIC
Principal Investigator: Pearce, J. B.
Performing Organization: U.S. Department of Commerce, Northeast Fisheries Center, Sandy Hook Laboratory, P. O. Box 428, Highlands, NJ 07732
Supporting Agency: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. No. MAC00776E1A1
Period: 7/75 to 6/76
Funds: $44,100

Environmental baseline surveys of sediments, benthic macrofauna, and a number of water column parameters have been completed for Raritan Bay, Long Island Sound, the New Jersey coast, and portions of the Baltimore Canyon Trough. Data from the latter two surveys are combined for subsequent determination of impacts of oil exploration activities.

[SSIE No. ZBP-1225]

Reports and Publications

BENTHIC ASSEMBLAGES IN THE DEEPER CONTINENTAL SHELF WATERS OF THE MIDDLE ATLANTIC BIGHT
Pearce, J. B. 1974.
Marine Environmental Implications of Offshore Oil and Gas Development in the Baltimore Canyon Region of the Mid-Atlantic Coast. Proceedings of Estuarine Research Federation Outer Continental Shelf Conference and Workshop, University of Maryland, 1974. p. 297-318.

The benthic assemblages collected from the continental shelf in the New York Bight are of average to high diversity. Approximately the same number of species and individuals per grab sample was found as in samples collected from uncontaminated areas in the Bight apex and inshore stations. Based on calculations from the data collected, it was found that the offshore shelf areas are represented by a total number of species similar to inshore stations in water 100 feet or less in depth. A discussion is given regarding the need for in-depth investigations of the distribution of benthic organisms in proposed sites of oil exploration and drilling, and the need for studies to determine the lethal and sublethal effects of known crude oils on marine benthic organisms characteristic of the continental shelf of the Middle Atlantic Bight.

OUR COASTAL WATERS: AN ENDANGERED ZONE
Pearce, J. B. 1976.
The Science Teacher 43(9). 4 p.

Discussed are the phenomenon of "coastal congestion," brought about by the development and increased population of the coastal and estuarine environments, and the threat to these areas caused by pollution from sewage and sludge, petroleum and power plants and by mineral resource development.

Information source: J. B. Pearce, U.S. Department of Commerce,
Northeast Marine Fisheries Center, Sandy
Hook Laboratory, Highlands, NJ 07732

E. FATE OF OIL IN THE ENVIRONMENT

1. BIODEGRADATION

R-227-74 (renewal)
BIODEGRADATION OF OIL IN SEAWATER FOR NAVAL POLLUTION CONTROL
Principal Investigator: O'Neill, T. B., and D. B. Chan
Performing Organization: U.S. Navy, Civil Engineering Laboratory, Point Mugu, Port Hueneme, California 93041
Supporting Agency: U.S. Department of Defense, Navy. No. DN144052
Period: 10/76 to 9/77

The objective of this research is to isolate microorganisms which can efficiently degrade petroleum and be grown in large quantities. The research will include a literature review, isolating of microbes from areas of Southern California where oil leakage is common, increasing their metabolic activity in pure or mixed cultures, and mass producing suitable organisms in order to eliminate oil through biodegradation.

[SSIE No. ZQN-144052-6]

R-339-74 (renewal)
NAVY ENVIRONMENT: BIOLOGY OF MARINE AND ESTUARINE MICROORGANISMS
Principal Investigator: Colwell, R. R., and J. D. Walker
Department: Microbiology
Performing Organization: University of Maryland, School of Agriculture, College Park, MA 20742
Supporting Agency: U.S. Department of Defense, Navy. No. DN223667, Contract N00014-75-C-0340
Period: 10/76 to 9/77
Funds: $29,641

The ability of marine and estuarine bacteria to degrade hydrocarbons and petroleum *in situ* is being tested by a variety of techniques including electron microscopy and gas liquid chromatography. The biodegradation of lipids and refractory materials in suspended particulates is being examined. The interactions of microorganisms in estuarine and oceanic ecosystems are investigated.

[SSIE No. GQN-223667-3]

Status: The investigators are presently in the process of writing up work on the Metula oil spill which was funded by the National Science Foundation.

Reports and Publications (Navy contract)

ENRICHMENT FOR ESTUARINE PETROLEUM-DEGRADING BACTERIA USING LIQUID AND SOLID MEDIA

Calomiris, J. J., B. Austin, J. D. Walker, and R. R. Colwell. 1977.
Journal of Bacteriology 42:135-144.

Bacteria in oil-contaminated and oil-free estuarine water and sediment were isolated on solid and in liquid petroleum media. A greater variety of bacteria was noted when direct plating techniques were employed, compared with liquid enrichment. Strains isolated by liquid enrichment were found more frequently to be capable of utilizing model petroleum *in vitro*, compared with isolates obtained by direct plating.

INTERACTIONS OF ARABIAN CRUDE OIL WITH BEACH SEDIMENT BACTERIA

Colwell, R. R., J. D. Walker, B. F. Conrad, and P. A. Seesman. 1977.
Final report, EPA Grant No. 68-01-3284. 78 p.

Beach sediment samples collected in the Straits of Magellan were examined for petroleum hydrocarbons and found to contain significant amounts of oil, with the concentration of oil related to degree of exposure to the "Metula" spill. The total number of viable, aerobic, heterotrophic microorganisms in the samples was found to decrease with increasing oil concentration. More rapid glucose uptake and mineralization by microorganisms were observed in clean sediment samples. Good growth in Arabian crude oil medium was obtained for most samples; however, the extent of degradation varied considerably with rate of removal of the major components of the oil. High concentrations of oil appeared to affect biodegradation adversely.

PETROLEUM HYDROCARBONS: DEGRADATION AND GROWTH POTENTIAL FOR ATLANTIC OCEAN SEDIMENT BACTERIA

Walker, J. D., J. J. Calomiris, T. L. Herbert, and R. R. Colwell. 1976.
Marine Biology 34(1):1-9.

Microorganisms isolated from sediment samples taken from three stations along a trackline off the North Carolina coast were examined for their ability to degrade a number of petroleum hydrocarbons. Bacteria from samples collected at a depth of 5,000 m showed greater growth and hydrocarbon degradation when cultured in a seawater medium than in media made up with salt solution. Growth of bacteria in sediment samples collected at two stations was suppressed in seawater medium when a 1% mixture of 19 different petroleum hydrocarbons was added.

LONG-CHAIN *n*-ALKANES OCCURRING DURING MICROBIAL DEGRADATION OF PETROLEUM

Walker, J. D., and R. R. Colwell. 1976.
Canadian Journal of Microbiology 22(6):886-891.

Five axenic cultures and a mixed culture were examined for their ability to degrade various crude oils. A wax was formed during the biodegradation of one of the crudes which was not observed during the weathering of the same oil. The wax contained high-boiling alkanes similar to those found in tar balls of the open ocean.

MEASURING THE POTENTIAL ACTIVITY OF PETROLEUM - DEGRADING BACTERIA

Walker, J. D., and R. R. Colwell. 1976.
Applied and Environmental Microbiology 31(2):189-197.

$[C^{-14}]$ hydrocarbons were used to evaluate the hydrocarbon-degrading potential of bacteria in estuarine and marine environments. Amount of mineralization of $[C^{-14}]$ hexadecane can be equated with the total number of petroleum-degrading bacteria and the percentage of the total heterotrophic bacterial population which they represent.

PETROLEUM DEGRADATION BY ESTUARINE ORGANISMS

Walker, J. D., and R. R. Colwell. 1976.
Proceedings of the Third International Biodegradation Symposium. J. M. Sharpley and A. M. Kaplan (eds.). Barking, Essex, Applied Science Publishers, Ltd., 1976. p. 197-204.
Symposium held in Kingston, Rhode Island, 17-23 August, 1975.

This paper reports on the seasonal variation in the numbers and activity of petroleum-degrading microorganisms from oil-contaminated and oil-free environments. Information on the susceptibility of petroleum to microbial degradation by indigenous microorganisms of Chesapeake Bay is presented.

[from Proceedings of the Third International Biodegradation Symposium. List of Contents. Applied Science Publishers, Ltd. July, 1976]

COMPARISON OF THE BIODEGRADABILITY OF CRUDE AND FUEL OILS

Walker, J. D., L. Petrakis, and R. R. Colwell. 1976.
Canadian Journal of Microbiology 22(4):598-602.

The ability of two crude and two fuel oils to support growth of a mixed population of estuarine bacteria was examined. Each of the oils supported a unique population of bacteria and yeasts. Low sulfur, high saturate South Louisiana crude oil was highly susceptible to degradation; in contrast, the dense high sulfur Bunker C fuel oil was strongly recalcitrant to biodegradation.

PETROLEUM HYDROCARBONS: DEGRADATION AND GROWTH POTENTIAL OF DEEPSEA SEDIMENT BACTERIA
Walker, J. D., P. A. Seesman, T. L. Herbert, and R. R. Colwell. 1976.
Environmental Pollution 10(2):89-99.

Bacteria from Atlantic marine sediments samples were able to degrade petroleum hydrocarbons in a seawater based medium. The inorganic nutrient concentration from both the seawater and the sediment had a large effect on degradation. Those bacteria from deep-ocean stations were more successful at degradation than those from coastal sediments.

Information source: R. R. Colwell, University of Maryland, Division of Agriculture and Life Sciences, Department of Microbiology, College Park, MD 20742

R-068-77
USE HETEROTROPHIC ACTIVITY TECHNIQUE FOR ASSAYING EFFECTS OF NUTRIENTS AND POLLUTION ADDITIONS UPON MICROBES OF NATURAL WATERS
Principal Investigator: Albright, L. J.
Performing Organization: Simon Fraser University, School of Science, Buraby, British Columbia, Canada
Supporting Agency: International Atomic Energy Agency. No. 1831/CF
Period: 8/76 to 7/77

The objective of this research is to develop an assay for determining the sub-lethal impact of various pollutants, including metallic salts, petroleum and pesticides, upon the heterotrophic activities of the total microflora (algae, bacteria, fungi and protozoa) of natural waters. The abilities of these waters and sediments to degrade petroleum and its products will be examined by adding 14C-labelled oil and oil products to the waters to determine degradation rates and turnover time with the use of the heterotrophic activity assay.

[SSIE No. CH-317]

R-069-77

BIOCONCENTRATION OF ENVIRONMENTAL CARCINOGENS - RESPONSE TO MARINE INVERTEBRATE MICROSOMAL OXIDASES TO ENVIRONMENTAL CARCINOGENS

Principal Investigator: Anderson, R. S.
Performing Organization: Sloan Kettering Institute of Canadian Research, 145 Boston Post Rd., Rye, NY 10580
Supporting Agency: U.S. Environmental Protection Agency, Office of Research and Development. No. R804435 01
Period: 1/76 to 12/76
Funds: $48,982

The capacity of marine organisms to metabolize environmental pollutants including pesticides and carcinogenic polycyclic hydrocarbons is being determined. Microsomal mixed function oxidases are being studied in the oyster, Crassostrea, virginica, and the lobster, Homarus americana. The general properties of the enzymes benzo(a)pyrene hydroxylase, DDT hydroxylase, aldrin epoxidase, and heptachlor epoxidase will also be studied.

R-070-77

INTERACTIONS OF CHEMICAL POLLUTANTS AND MICROORGANISMS IN THE NEW JERSEY COASTAL ENVIRONMENT

Principal Investigators: Bartha, R., and A. D. Antoine
Performing Organization: Rutgers The State University, Agricultural Experiment Station, Old Queens Bldg., New Brunswick, NJ 08903
Supporting Agency: U.S. Department of Agriculture, Cooperative State Res. Service, New Jersey
Period: 10/76 to 9/77

The interaction of various chemical pollutants, such as petroleum hydrocarbons, polychlorinated biphenyls, heavy metals, etc., will be investigated in both laboratory and field experiments. The action of the pollutants on essential microbial processes, such as organic matter degradation, nitrification, nitrogen fixation, etc., will be examined. The concentration of pollutants in microorganisms and through them in higher members in estuarine food chains will be measured by radiometric techniques.

[SSIE No. GY-68007-1]

Status: The biodegradation of South Louisiana (SL) crude oil, and the effects of nitrogen, phosphorus and iron supplements on this process were compared in a polluted and in a relatively clean littoral seawater sample taken along the New Jersey coast. Without supplements, the biodegradation of the oil was negligible in both samples. Addition of nitrogen and phosphorus allowed very rapid biodegradation in polluted seawater (72% in three days). Total iron in this seawater sample was high (5.2 uM). In the less polluted and less iron-rich (1.2 uM) sample, biodegradation of the crude oil was considerably slower (21% in three days) and the addition of chelated iron had a stimulating effect. It was also found that ferric octoate in combination with paraffinized urea and octylphosphate is suitable for the treatment of floating oil slicks. The investigators have concluded that spills of SL crude oil can be cleaned up rapidly and efficiently by stimulated biodegradation, provided the water temperatures are favorable.

2. PHYSICAL CHANGES OF OIL

R-071-77

OIL SLICK SPREADING DUE TO TURBULENT DIFFUSION

Principal Investigator: Miksad, R. W.
Performing Organization: University of Texas, School of Engineering, 200 W. 21st St., Austin, TX 78712
Supporting Agency: University of Texas
Period: 7/75 to 6/76

The research is aimed at providing new information on turbulent oil slick spreading rates via laboratory experiments. The technique of grid generated turbulence in a horizontal plane is used to model the structure of atmospheric and ocean turbulence. The length scale, frequency, and intensity of the turbulent field can be varied to model different turbulent spill situations unique to the Texas Gulf Coast.

[SSIE No. NTX-693]

R-072-77

SEA-STATE LIMIT FOR THE SURVIVAL OF OIL SLICKS

Principal Investigator: Unknown
Performing Organization: Arthur D. Little, Inc., 25 Acorn Ave., Cambridge, MA 02142
Supporting Agency: U.S. Department of Transportation, Office of the Secretary. No. CG59184, Contract CG-61, 505-A.
Period: 3/76 to 2/77

The project aims are to investigate and discuss the available literature on theoretical and experimental work relating to wind, waves, currents, and oil slicks; identify environmental and oil-dependent factors that affect the dispersion of oil; assess the most severe conditions under which an oil slick can remain undispersed; formulate a physical model describing the hydrodynamics

of an oil slick breaking up in the sea; and define how "sea-state" is to be determined in the field.
[SSIE No. GZO-633]

3. CHEMICAL CHANGES OF OIL

R-073-77
HYDROCARBONS IN MARINE WATERS - THE COLLOIDAL STATE

Principal Investigator:	Shaw, D. G.
Performing Organization:	University of Alaska, Institute of Marine Sciences, Fairbanks, AK 99701
Supporting Agency:	U.S. National Science Foundation, Division of Environmental Sciences. No. DES75-10753
Period:	5/76 to 4/77
Funds:	$47,100

Procedures for measuring colloidal sized hydrocarbon particles by gel permeation chromatography are being developed and used to assess the influence of hydrocarbon type, turbulence, and the natural organic constituents of seawater on colloid formation. This work is being done to increase our present understanding of the chemical behavior of hydrocarbons in seawater.

[SSIE No. GSV-6063-1]

4. GENERAL FATE OF OIL

R-074-77
OIL AND TAR SEEPS OFF SOUTHERN CALIFORNIA

Principal Investigators:	Henyey, T. L., and T. F. Yen
Performing Organization:	University of Southern California, School of Letters Arts and Sciences, 3551 University Ave., Los Angeles, CA 90007
Supporting Agency:	U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Sea Grant Office. No. R/RD-2
Period:	7/75 to 6/76
Funds:	$39,285

The following are research objectives: use chemical parameters including trace elements, sulfur and nitrogen content, carbon isotopic ratio, and volatile organic components to characterize oil and tar from natural seeps, offshore wells and beaches; investigate the geochemical breakdown or weathering of oil and tar from natural seeps as it moves in the marine environment; relate characterization of oils and tars to the problems of source and the subsequent weathering in the marine environment; and determine the geologic, geophysical, and oceanographic framework of selected oil and tar seeps in the Santa Barbara Channel and Santa Monica Bay.

[SSIE No. GBP-2627]

R-075-77
REVIEW AND EVALUATION OF OIL SPILL TRAJECTORY MODELS FOR USE IN RISK ASSESSMENT ASSOCIATED WITH PROPOSED DEEPWATER PORTS

Principal Investigators:	Pearce, B. R., J. J. Connor, K. D. Stolzenbach, E. E. Adams, J. Pagenkopf
Performing Organization:	Massachusetts Institute of Technology, School of Science, 77 Massachusetts Ave., Cambridge, MA 02139
Supporting Agency:	U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Sea Grant Office. No. R/PO-3
Period:	7/75 to 6/76
Funds:	$60,000

The objective of the project is to evaluate all numerical models that have been developed for actual application in predicting oil spill trajectories. The adequacy, practical requirements in running the models, suitability of each model to different water bodies, and degree of sophistication involved will be assessed.

[SSIE No. GBP-2406]

Reports and Publications

A REVIEW AND EVALUATION OF BASIC TECHNIQUES FOR PREDICTING THE BEHAVIOR OF SURFACE OIL SLICKS
Stolzenbach, K. D., O. S. Madsen, E. E. Adams, A. M. Pollack, and C. K. Cooper. 1977.
Ralph M. Parsons Laboratory for Water Resources and Hydrodynamics, Report No. 222. 315 p.

The purpose of the study is to conduct a state-of-the-art review of the basic techniques and knowledge associated with surface oil slick behavior. Results of this review are presented in the following manner: representation and determination of wind fields; treatment of the advection of oil slicks that is brought about by the combined action of currents and wind-waves; the physical phenomena that transform an oil slick as it is being advected; and a review and evaluation of existing models for oil slick behavior. A comprehensive bibliography is included at the end of the report.

Information source:	C. Bowman, Massachusetts Institute of Technology, Ralph M. Parsons Laboratory for Water Resources and Hydrodynamics, Bldg. 48-323, Cambridge, MA 02139

SECTION III: CURRENT CONFERENCES

*Additional information not available at time of publication.

Feb. 28- Mar. 4 Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, 28th, Cleveland, Ohio, 1977.

Oil Pollution Related Papers

Paper 295
THE HYDROCARBON CONTENT OF WATER IN SIMULATED OIL SPILLS
Shaw, D. G., L. E. Clement, and C. Akert

Paper 333
QUANTITATIVE EFFECTS OF WEATHERING ON GC IDENTIFICATION OF OILS
Flanigan, G. A., and A. P. Bentz

Paper 334
QUANTITATIVE EFFECTS OF WEATHERING ON INFRARED SPECTRA OF OILS
Gronlund, W. R., and C. P. Chamberlain

Paper 335
ON THE INDEPENDENCE OF FLUORESCENCE AND INFRARED SPECTRA FOR OIL SPILL IDENTIFICATION
Killeen, T. J., and Y. T. Chien

Paper 336
DESCRIPTIVE MEASURES OF DIFFERENCES IN CHEMICAL DATA FOR OIL IDENTIFICATION
Chien, Y. T., and T. J. Killeen

Paper 337
USE OF A NITROGEN-SENSITIVE DETECTOR FOR OIL IDENTIFICATION
Flanigan, G. A.

Paper 338
CHARACTERIZATION OF SYNTHETIC FUELS BY LIQUID CHROMATOGRAPHY AND MATRIX ISOLATION SPECTROSCOPY
Wehry, E. L., G. Mamantov, R. R. Kemmerer, E. R. Hinton, R. C. Stroupe, and G. Goldstein.

Paper 339
CHEMICAL COMPOUND TYPES IN PETROLEUM RESIDUES
McKay, J. F., P. J. Amend, T. E. Cogswell, P. M. Harnsberger, R. B. Erickson, and D. R. Latham

Paper 340
ANALYSIS OF PETROLEUM FROM THE MARINE ENVIRONMENT
Lynch, P. F., M. Ahmadjian, F. E. Franklin, and C. W. Brown

Paper 394
PRELIMINARY INVESTIGATIONS ON THE CONTINUOUS FLUORESCENCE EMISSION IDENTIFICATION OF HPLC ELUENTS
Saner, W. A., J. R. Jadamec, K. Kallet, S. Cravitt, and D. Baker

Paper 395
FLUORESCENCE AND LOW TEMPERATURE LUMINESCENCE STUDIES ON WEATHERED OILS
Eastwood, D., M. S. Hendrick, and S. H. Fortier

Paper 396
IMPROVED IDENTIFICATION OF OILS BY LOW TEMPERATURE TOTAL LUMINESCENCE SPECTROSCOPY
Brownrigg, J. T., and A. W. Hornig

Paper 397
FURTHER DEVELOPMENTS IN OIL IDENTIFICATION BY TOTAL LUMINESCENCE SPECTROSCOPY
Giering, L. P., and A. W. Hornig

Paper 398
IMPROVED DETECTABILITY OF OIL SPILLS BY USE OF CONCAVE HOLOGRAPHIC GRATINGS
Todd, E. D., A. Samoun, and D. O. Landon

Paper 399
FINGERPRINTING PETROLEUM OILS WITH LOW TEMPERATURE DERIVATIVE FLUOROMETRY
Kolb, D. A., and K. K. Shearin

Paper 400
DETERMINATION OF PETROLEUM OILS IN SEDIMENTS BY FLUORESCENCE SPECTROSCOPY AND NMR
Frank, U., and M. Gruenfeld

A volume of collected abstracts is available to registrants of the conference; however, the volume is not considered a publication and abstracting of individual papers is not permitted.

FFI contact Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Suite 215, Whitehall Center, Pittsburgh, PA 15227

April 13-15 Annual SPE of AIME California Regional Meeting, 47th, Bakersfield, California, 1977.
Sponsored by the Society of Petroleum Engineers of AIME.

The conference theme, Energy, the Great Race, includes presentations by industry and government agency representatives on present and future trends in environmental regulations that will affect California's petroleum industry.

Oil Pollution Related Papers

SPE 6518
HISTORY OF THE FORMATION OF AN OIL SPILL CONTINGENCY ORGANIZATION
Barker, C. D.

The formation of an oil spill contingency organization is traced from its inception in early 1977. The selection of cleanup equipment, ongoing equipment testing programs, equipment inventory, and the state of readiness and future plans of the organization are discussed.

SPE 6335
FATE OF OIL AND EFFECTS ON MARINE LIFE
Lasday, A. H., and E. W. Mertens

The results of an API-sponsored, six year research program on the fate and effects of spilled crude oil and petroleum products on the marine environment are summarized.

FFI contact Society of Petroleum Engineers of AIME, 6200 North Central Expressway, Dallas, TX 75206

May 2-5 Annual Offshore Technology Conference, 9th, Houston, Texas, 1977.
Sponspored by American Institute of Mining, Metallurgical and Petroleum Engineers, American Association of Petroleum Geologists, American Institute of Chemical Engineers, American Society of Civil Engineers, American Society of Mechanical Engineers, Marine Technology Society, Institute of Electrical and Electronics Engineers, Society of Exploration Geophysicists, and Society of Naval Architects and Marine Engineers.

Oil Pollution Related Papers

Session: Geologic Hazards of U.S. Outer Continental Slope and Shelf

OTC 2733
GEOLOGICAL HAZARDS OF UPPER CONTINENTAL SLOPE OF GULF OF MEXICO
Garrison, L. E., T. Tatum, Jr., J. S. Booth, and S. M. Casby

OTC-2734
EVALUATION OF GEOLOGIC HAZARDS IN OCS PETROLEUM LEASE AREAS,SOUTHERN CALIFORNIA CONTINENTAL BORDERLAND
Field, M. E., S. H. Clarke, H. G. Greene, and H. C. Wagner

Session: Environmental and Pollution Considerations--Environmental Impact Studies

OTC 2752
OIL IN MARINE WATERS
Frey, M. G.

OTC 2753
MID-ATLANTIC OCS BENCHMARK STUDIES
Lynch, M. P.

OTC 2754
INTEGRATED ENVIRONMENTAL STUDIES, SOUTH TEXAS OUTER CONTINENTAL SHELF: APPROACH, TECHNIQUES, RESULTS
Berryhill, H. L.

OTC 2756
OCS DEVELOPMENT IN THE SANTA BARBARA CHANNEL: LACK OF DETECTABLE IMPACT ON FISHERIES
Hester, F. J., and R. Evans

OTC 2758
A ONE-HUNDRED-TON OIL RECOVERY VESSEL FOR BANTRY BAY
Neal, R. W., R. A. Bianchi, and E. Marcus

OTC 3039
HOW THE FEDERAL GOVERNMENT WILL HELP STATES DEAL WITH ONSHORE IMPACTS OF OFFSHORE OPERATIONS
Knecht, R. W.

Session: Remote Sensing

OTC 2763
USE OF LANDSAT DATA FOR THE DETECTION OF MARINE OIL SLICKS
Deutsch, M., and J. E. Estes

OTC 2764
MODELLING OF OIL SPILL TRAJECTORIES USING SEQUENTIAL SATELLITE IMAGERY
McLeod, W. R., J. H. Kennedy, and D. T. Hodder

OTC 2765
NATURAL OIL SEEP DETECTION IN MARINE ENVIRONMENTS
Eyers, J. A., J. E. Forman, and G. L. Raney

Session: Blowout and Production Control

OTC 2766
NEW INNOVATIONS FOR FIGHTING BLOWOUTS
Lewis, J., R. Barnett, G. Mabie, and J. Harris

OTC 2768
A HIGH RELIABILITY OIL-FILLED CABLE HARNESS ASSEMBLY FOR USE ON AN UNDERWATER BLOWOUT PREVENTER SYSTEM
Miller, W. C., JR., and W. M. Sowers

OTC 2769
ELECTROMECHANICAL CABLES FOR BOP CONTROL SYSTEMS: PROBLEMS AND SOLUTIONS
Kerr, W. L., and F. Sawin

OTC 2770
REVIEW OF RELIABILITY AND PERFORMANCE OF SUBSURFACE SAFETY VALVES
Purser, P. E.

Session: Offshore Safety

OTC 2871
SAFE, POLLUTION-FREE TESTING OF OFFSHORE AND ARCTIC WELLS
Nutter, B. P., H. L. McGill, B. J. Scott, and H. D.Frye

Session: Arctic Environmental Conditions and Processes

OTC 2945
STAMUKHI ZONE PROCESSES: IMPLICATIONS FOR DEVELOPING THE ARCTIC OFFSHORE AREA
Reimnitz, E., L. J. Toimil, and P. W. Barnes

OTC 2946
ALONG-SHORE COHERENCE OF WINDS ALONG THE NORTH ALASKAN COAST FOR OIL SPILL ANALYSIS
Hufford, G. L., J. P. Welsh, and I. M. Lissauer

OTC 2949
SEA ICE THICKNESS PROFILING AND UNDER-ICE OIL ENTRAPMENT
Kovacs, A.

Session: Processing and Treating in Drilling and Production Operations

OTC 2755
ENVIRONMENTAL ASPECTS OF DRILLING MUDS AND CUTTINGS FROM OIL AND GAS EXTRACTION OPERATIONS IN OFFSHORE AND COASTAL WATERS
Monaghan, P. H., C. D. McAuliffe, and F. T. Weiss

OTC 3040
FATE OF DRILL CUTTINGS: IN THE MARINE ENVIRONMENT
Zingula, R. P., and D. W. Larson

FFI contact Program Manager, Offshore Technology Conference, 6200 N. Central Expressway, Dallas, TX 75206.

*May 2-13 Mid-Term Expert Consultation of the Joint Coordinated Project on Pollution in the Mediterranean, Dubrovnik, Yugoslavia.
Sponsored by the General Fisheries Council for the Mediterranean/United Nations Environment Programme.

FFI contact Dr. D. Charbonnier, Department of Fisheries, Food and Agriculture Organization of the UN, Via delle Terme di Caracalla, 00100 Rome, Italy

May 8-13 Annual Meeting of the American Society for Microbiology, 77th, New Orleans, Louisiana, 1977.

Oil Pollution Related Papers

Paper Q43
A BACTERIOLOGICAL STUDY OF FIN ROT IN MULLET ASSOCIATED WITH EXPOSURE TO CRUDE OIL
Giles, R. C., and L. R. Brown.

Fin rot infections resulted in mullet (*Mugil cephalus*) when they were experimentally exposed to 4.0-5.0 mg/l crude oil concentrations in estuarine ponds. Depending on the crude oil used, about 96-97% of the fish developed the infection as compared to 6-7% in control ponds. This paper reports microbiological aspects of the course of the infection as documented from two months of observation following exposure to the oil.

Paper Q44
THE EFFECT OF PRUDHOE CRUDE OIL ON PRIMARY PRODUCTION IN ARCTIC PONDS
Vestal, J. R., T. W. Federle, G. R. Hater, and M. C. Miller

In controlled pond experiments, soluble components of crude oil were found to curtail or completely inhibit primary production of phytoplankton within a few days. As the toxic components of oil were subsequently lost, the primary production slowly recovered, but with a significant shift in the species dominance from Cryptophytes to Chrysophytes.

Paper Q45
EFFECTS OF CRUDE OIL ON BACTERIAL AND FUNGAL POPULATIONS IN FRESH WATER ARTIFICIAL PONDS
Breuil, C., and D. B. Shindler

The effects of winter under-ice crude oil spills on the microbial population of artificial freshwater ponds were monitored for over a year, and seasonal variations in bacterial and fungal populations are reported.

Paper Q46
MICROBIAL CONTRIBUTION TO WASTE OIL DECOMPOSITION IN SOIL IN AN ARID SITE
McDonald, S., and J. Skujins

Microbial aspects of the degradation of oil under arid conditions were monitored for 3 years and correlated with biochemical changes in soil, disappearnce of the oil, climate, addition of N, P, and Ca nutrients, and response in vegetation. Biodegradation was achieved primarily by greatly enlarged populations of lipolytic bacteria aided by some fungi; it occurred best under aerobic conditions, elevated temperatures, and availability of water and nitrogen. About 80% of the oil was degraded in 3 years, leaving a humus-like organic fraction in the soil.

Paper N63

EMULSIFICATION OF HYDROCARBONS BY BACTERIA FROM FRESHWATER ECOSYSTEMS

Broderick, L. S., and J. J. Cooney.

Bacteria which utilize hydrocarbons as a sole carbon source were studied for their ability to form stable emulsions of kerosene and water. All of the organisms which grew on kerosene also emulsified kerosene. However, there was no correlation between the observed emulsifying activity and the history of hydrocarbon pollution of the ecosystems from which the organisms were isolated.

Paper N72

EFFECT OF PETROLEUM HYDROCARBONS ON SALT MARSH MICROBIAL COMMUNITIES

Ereditario, J. M., and F. K. Pfaender

The effects of motor oil and diesel fuel hydrocarbons on microbial communities were studied in simulated salt marsh ecosystems. Based on plate and epifluorescence counts, total viable organisms initially decreased, coincident with a relative increase of hydrocarbon degraders. After 5 days and until the end of the experiment (5 weeks), the total populations gradually increased, coinciding with a stabilizing of the number of oil degraders. Final species diversity index averages were about the same as the control in the ecosystems receiving low hydrocarbon concentrations and slightly lower in those receiving high concentrations.

Paper Q82

INTERACTIONS OF MICROORGANISMS AND HYDROCARBONS FOLLOWING AN ACCIDENTAL LEAKAGE OF GASOLINE INTO A FRESHWATER LAKE AT BARROW, ALASKA

Horowitz, A., and R. M. Atlas.

After a 190,000 l (50,000 gal) leakage of gasoline into an arctic lake, changes in microbial communities in surface waters and sediments were monitored, and their ability to degrade hydrocarbons was determined *in situ*. Initially, the heterotrophic bacteria decreased in number, then increased to 10 times their original number. Their physical distribution paralleled the spread of gasoline contamination in the lake and sediments. About 99% of the hydrocarbons in the sediments were lost by natural weathering and biodegradation within 5 weeks.

Paper Q83

USE OF ^{14}C RADIOLABELLED HYDROCARBON SPIKED CRUDE OIL TO ASSESS OIL BIODEGRADATION POTENTIAL IN THE BEAUFORT SEA

Roubal, G., and R. M. Atlas

Ice, water, and sediment samples from the Beaufort Sea were collected in winter and in summer and incubated with Prudhoe crude oil spiked with ^{14}C radiolabelled hydrocarbons. Hydrocarbon biodegradation potentials in summer were found to be an unexpected 80% lower than biodegradation rates from comparable sediment and water samples taken in winter. Surface ice samples had biodegradation potentials that averaged 75% less than water and sediment samples.

Paper Q84

OPTIMIZATION STUDIES ON OIL SLUDGE DISPOSAL IN SOIL

Dibble, J. T., and R. Bartha

Parameters which affect the biodegradation of oil sludge in soil were studied in order to optimize this method for disposing of oil storage and refinery wastes. The greatest positive effect on the rate and extent of oil sludge degradation resulted from a combination of a slightly alkaline soil pH, a moderate loading rate of 10%, and a mesophilic temperature of 28°C. Using this combination, up to 35% of ether extractable hydrocarbons were biodegraded in 100 days.

Paper Q85

UTILIZATION OF AROMATIC HYDROCARBONS BY STRAINS OF *ACINETOBACTER*

Kunz, D. A., and P. J. Chapman

Aromatic hydrocarbon degradation by microorganisms can be attributed in part to their ability to elaborate enzymes of the catechol *ortho* and *meta*-fission pathways. Two distinct modes of substrate degradation which can be correlated with the enzymology of catabolic pathways used by *Acinetobacter* are detailed, based on patterns of hydrocarbon utilization, rates of oxidation by intact cells, and enzyme assays. Results show that members of the genus *Acinetobacter* exhibit varying abilities to elaborate enzymes of the catechol *meta*-fission route as is the case in genus *Pseudomonas*.

A volume of collected abstracts is available as ASM Bacteriological Proceedings, 1977. Abstracts of the 77th Annual Meeting of the American Society for Microbiology.

FFI contact R. W. Sarber, American Society for Microbiology, 1913 I St., N.E., Washington, D.C. 20036.

May 9-12 API Refining Department, 42nd Midyear Meeting, Chicago, Illinois, 1977.

Oil Pollution Related Papers

Session on Water Conservation

TRACE CONTAMINANTS IN REFINING EFFLUENTS - AN OVERVIEW OF THE SAMPLING AND ANALYSIS PROBLEM AND ITS IMPLICATIONS
Hallett, J. D.

Summary not available.

API BIOENHANCEMENT STUDY
Crame, L. W.

Several activated sludge treatment systems for refinery wastewater treatment were evaluated to find cost-effective methods that will meet the proposed 1983 EPA refinery effluent limitations. It was concluded that extensive pretreatment, followed by a high sludge age activated sludge-powdered carbon system, more cost-effectively produces an effluent comparable to that resulting from tertiary granular carbon adsorption.

EFFLUENT QUALITY IMPROVEMENT BY POWDERED ACTIVATED CARBON IN REFINERY ACTIVATED SLUDGE PROCESSES
Grieves, C. G., M. K. Stenstrom, J. F. Grutsch, and J. D. Walk

Addition of powdered activated carbon to activated sludge processes in refinery effluent treatment can significantly increase the effluent quality by reducing soluble organic carbon content by as much as 50% as well as reducing other pollutant concentrations. The benefits of activated carbon addition were demonstrated in a 9-month pilot study at an Amoco refinery, and the results of the study are presented.

ARCO-EPA LABORATORY EVALUATION OF ACTIVATED CARBON TREATMENT OF REFINERY WASTEWATERS
Knecht, A. T., Jr.

An ongoing investigation of the efficacy of activated carbon treatment of refinery process wastewaters is described. The purpose of this research is to determine if modifications in operating conditions of activated sludge treatment systems, alone or with added carbon treatment methods, can approach or meet the proposed 1983 EPA refinery effluent quality standards.

Session on Toxicity and Worker Health

A REVIEW OF THE TOXICOLOGICAL IMPLICATIONS OF THE USES OF PETROLEUM PRODUCTS, BASED ON API SPONSORED RESEARCH IN PRODUCT SAFETY
Scala, R. A.

Since 1968, API has sponsored experimental studies on the toxicology of crude oil, oil shale, and petroleum products, including gasoline, solvents, and benzene, in order to characterize the potential health hazards of these materials and to determine safe exposure levels. The results and implications of these studies are discussed.

UPDATE OF PETROLEUM REFINERY MORTALITY STUDY
Tabershaw, I. R.

An excess mortality from lymphoma was found in a 1974 epidemiologic study of petroleum refinery workers. This study formed the basis of follow-up studies of the same group of workers. The applicability, adequacy, conclusions, and implications of these studies in determining the health of a population are discussed.

FFI contact American Petroleum Institute, Publications and Distribution Section, 2101 L Street, N. W., Washington, D.C. 20037.

May 23-27 International Coral Reef Symposium, 3rd, Miami, Florida, 1977.

Oil Pollution Related Papers

HARMFUL EFFECTS OF CHRONIC OIL POLLUTION ON A RED SEA SCLERACTINIAN CORAL POPULATION
Rinkevich, P., and Y. Loya

"Field observations and histological studies of two populations of Stylophora pistillata in chronically oil-polluted reefs vs. clean reefs revealed the following detrimental effects on the polluted coral population: Decreased viability of colonies, direct damage to gonads, decreased production and viability of planulae and prevention of successful planulae settlement."

FFI contact Reef Symposium, University of Miami, Fisher Island, Miami, FL 33139.

May 29- June 3 Annual Conference on Mass Spectrometry and Allied Topics, 25th, Washington, D.C., 1977.
Sponsored by the American Society for Mass Spectrometry.

Oil Pollution Related Papers

Session F: Environmental Applications

Paper F8
ANALYSIS OF POLYCYCLIC AROMATIC HYDROCARBONS BY PULSED POSITIVE NEGATIVE ION CIMS WITH OXYGEN AS THE REAGENT GAS
Hunt, D. F., W. C. Brumley, G. C. Stafford, and F. M. Botz

Paper F10
A SORBENT EXTRACTION APPROACH FOR DESORBING ORGANIC POLLUTANTS COLLECTED ON POROUS POLYMERS
Sherman, P. K., and G. W. Puttler

Poster Session - Tuesday: Group II. Environmental

Paper Tu9
GC/HIGH RESOLUTION MS FOR ENVIRONMENTAL MONITORING
Shrader, S. R., and J. A. Defever

Paper Tu12
HYDROCARBONS IN THE ENVIRONMENT SURROUNDING AN ACTIVE OILFIELD IN THE NORTHWESTERN GULF OF MEXICO
Middleditch, B. S., B. Basile, and E. S. Chang

Poster Session - Wednesday: Group I. Negative Ions Computer Applications

Paper We22
ANALYSIS OF POLYAROMATIC HYDROCARBONS USING NEGATIVE ION CHEMICAL IONIZATION
Prater, T. J., and T. M. Harvey

Proceedings of the conference will be published in late 1977 as a book of long abstracts available only to members of ASMS.

FFI contact Dr. K. E. McCulloh, A-145 Chemistry Bld., National Bureau of Standards, Washington, D. C. 20234.

June 1-3 International Symposium on Environmental Pollutants, University of Connecticut, Storrs, Connecticut, 1977.
Sponsored by the Northeastern Research Center for Wildlife Diseases, University of Connecticut; The Registry of Comparative Pathology, Armed Forces Institute of Pathology; and the Institute of Laboratory Animal Resources, National Research Council.

The conference subtitle is: An International Symposium on the Pathobiology on Environmental Pollutants--Animal Models and Wildlife as Monitors

Oil Pollution Related Papers

Paper 5
EFFECTS OF CRUDE OIL INGESTION ON HERRING GULLS AND WHITE PEKING DUCKS
Miller, D. S., D. B. Peakall, and W. N. Kinter

Paper 6
CONGENITAL ABNORMALITIES IN THE KILLIFISH, *FUNDULUS HETEROCLITUS*, EXPERIMENTALLY INDUCED BY ENVIRONMENTAL CONTAMINANTS
Weis, P., and J. S. Weis

Paper 7
HYDROCARBON POLLUTION AND THE PREVALENCE OF NEOPLASIA IN FERAL NEW ENGLAND SOFT-SHELL CLAMS, *MYA ARENARIA*
Brown, R. S., R. E. Wolke, C. W. Brown, and S. B. Saila

Paper 8
BENZO(a)PYRENE LEVELS AND NEOPLASTIC DISEASES IN BIVALVE MOLLUSKS FROM OREGON ESTUARIES
Mix, M. C., et al.

Paper 9
THE AMERICAN OYSTER *CRASSOSTREA VIRGINICA* AS AN INDICATOR OF CARCINOGENS IN THE AQUATIC ENVIRONMENT
Couch, J. A., L. Courtney, and J. Winstead

Paper 10
EVALUATION OF INORGANIC AND ORGANIC AQUATIC POLLUTANTS USING FISH AND AMPHIBIAN EGGS AS BIOASSAY AND BIOINDICATOR ORGANISMS
Birge, W. J.

Paper 11
PRELIMINARY ASSESSMENT OF THE FLATFISH AS A WILDLIFE MONITOR OF POLLUTION
Landolt, M., W. Iwaoka, K. Pierson, and S. P. Felton

Paper 19
ALTERED IMMUNE RESPONSE BY ENVIRONMENTAL CONTAMINANTS
Koller, L. D.

Paper 20
THE MOLLUSCAN KIDNEY AS A POLLUTION INDICATOR, HISTOPATHOLOGIC STUDIES AND CHEMICAL ANALYSIS
Rheinberger, R. V., G. L. Hoffman, and P. P. Yevich

Paper 35
AN OVERVIEW OF RESEARCH ON THE EFFECTS OF ENVIRONMENTAL POLLUTANTS ON ANIMALS
Pilchard, E. I.

Proceedings of the conference will be published by the National Research Council, 2101 Constitution Ave., Washington, D.C. 20418

FFI contact G. Migaki, D. V. M., Registry of Comparative Pathology, Armed Forces Institute of Pathology, Washington, D.C. 20306.

June 6-9 Annual Conference on Trace Substances in Environmental Health, 11th, University of Missouri, Columbia, Missouri, 1977. Sponsored by University of Missouri Environmental Trace Substances Center, University of Missouri Extension Division; and RANN Program, National Science Foundation.

Oil Pollution Related Papers

Session on Environmental Pollution
TOXIC TRACE ELEMENTS AND OIL SHALE PRODUCTION
Chappell, W. R., and D. D. Runnells

Conference proceedings are available in a ten-volume set which may be ordered individually. Reprints of individual papers are not available.

FFI contact Extension Publications, 211 Whitten Hall, University of Missouri, Columbia, MO 65201.

*Aug. 21-26 Annual AIBS Meeting, 28th, Michigan State University, East Lansing, Michigan, 1977.

FFI contact American Institute of Biological Sciences, 1401 Wilson Blvd., Arlington, VA 22209.

*Aug. 28-31 Interamerican Congress of Chemical Engineering, 7th, Denver, Colorado, 1977.
Sponsored by the American Institute of Chemical Engineers, and Interamerican Congress of Chemical Engineering.

The conference includes a session on environmental pollution and environmental aspects of tar sand processing.

FFI contact Dr. J. N. Vera, Department of Chemical Engineering, McGill University, P.O. Box 6070, Station A, Montreal, Quebec H3C 3GI, Canada.

*Aug.28- Sept. 2 American Chemical Society National Meeting, 174th, Chicago, Illinois, 1977.

FFI contact A. T. Winstead, American Chemical Society, 1155 16th St., N. W., Washington, D. C. 20036.

Sept. 14-16 The Oil Industry and Microbial Ecosystems, University of Warwick, Coventry, England, 1977.
Sponsored by the Institute of Petroleum, London.

Oil Pollution Related Papers

Session 1545: Interaction of Oil and Petrochemicals with Microorganisms

SOIL
Blakeborough, N.

FRESHWATER ECOSYSTEMS
Author to be announced.

MARINE ECOSYSTEMS
Stanley, S. O.

Session 0915: Biodegradation

BIODEGRADATION OF HYDROCARBONS
Westwood, A., and I. J. Higgins

THE ROLE OF MICROBIAL COMMUNITIES IN THE NATURAL ENVIRONMENT
Slater, H.

MONITORING AND ASSESSMENT OF BIODEGRADATION
deKreuk, J. F.

FFI contact Ms. L. Boothby, Conference Officer, Institute of Petroleum, 61 New Cavendish St., London W1M 8AR, England

*Sept. 26-28 International Symposium on Aquatic Pollutants,2nd, Noordwijkerhout, The Netherlands, 1977.

The conference will include about 20 papers on transport, transformation, identification, and biological effects of aquatic pollutants.

FFI contact G. L. Baughman. Environmental Research Laboratory, EPA, College Station Rd., Athens, GA 30601

Oct 2-7 Water Pollution Control Federation Annual Conference and Exhibition, 50th, Philadelphia, Pennsylvania, 1977.

The conference will include sessions on prevention and control of oil and hazardous material spills and other forms of marine pollution.

Oil Pollution Related Papers

Session 2: Industrial Case Histories

KANSAS CITY REFINERY'S WASTEWATER MANAGEMENT PROGRAM USING ROTATING DISC TECHNOLOGY
Godlove, J. W., W. C. McCarthy, H. H. Comstock, and R. O. Dunn

Session 8: Industrial Wastes

RESPONSE TO SPILLS IN ONTARIO
Belling, P. G.

MARINE SPILL ASSESSMENT, PREVENTION AND CONTROL PROGRAM FOR THE DOW CHEMICAL COMPANY'S PROPOSED PETROCHEMICAL FACILITY
Bauer, D. L., and K. S. Dunbar

Session 16: International Session

RECENT DEVELOPMENTS IN OIL SPILL DISPERSANTS AND THEIR USAGE
Marum, J. P.

ARCTIC WATERS AND THEIR PROTECTION
Clare, H. H.

FFI contact Robert Dark, Conference Manager, Water Pollution Control Federation, 2626 Pennsylvania Ave., Washington, D.C. 20037.

Oct. 3-5 Oil Spill Prevention, Control and Cleanup, 2nd Offering, East Brunswick, New Jersey, 1977.

This is a three-day intensive course for scientists, engineers, first-line supervisors, industrial managers and governmental personnel.

Course Outline

First Day

SOURCES, CAUSES AND MAGNITUDE OF SPILLS
FEDERAL LEGISLATION
BIOLOGICAL FATE AND EFFECTS OF OIL
EPA SPILL PREVENTION PLAN
CLEANUP OF OIL POLLUTED SHORELINES
ROLE OF ON SCENE COORDINATOR (OCS)

Second Day

STREAM AND RIVER CLEANUP
RECOVERY OF OIL
FIELD DEMONSTRATION

Third Day

USE OF DISPERSANTS
USE OF SORBENTS
USE OF BURNING AGENTS & SURFACE COLLECTING AGENTS
DISPOSAL OF RECOVERED OILY MATERIAL
PRACTICAL TRAINING PROBLEMS

FFI contact The Center For Professional Advancement, P.O. Box H, East Brunswick, NJ 08816.

Oct. 4-5 ASTM Symposium on Chemical Dispersants for the Control of Oil Spills, Williamsburg, Virginia, 1977.
Sponsored by the American Society for Testing and Materials, Committee F-20 on Spill Control Systems.

The conference will contain technical and scientific presentations including detailed descriptions of the performance and biological effects of proprietary products. Papers will be presented on 1) methods of application of chemical dispersants, 2) new developments in the areas of chemicals and the testing of dispersants, 3) experiences in the use of dispersants, 4) biological effects of dispersants, 5) testing of dispersants, and 6) criteria and guidelines for use of dispersants.

FFI contact the American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103.

Oct. 4-8 OCEANEXPO 77, 3rd International Exhibition on the Exploitation of the Ocean, Bordeaux, France, 1977.

The Exhibition will include displays of equipment for pollution control and combat including mobile dams, booms, and related equipment; pollution monitoring, measuring and surveillance devices; and specialized vessels.

FFI contact TECHNOEXPO, 8 Rue de la Michodiere, 75002 Paris, France

Oct. 11-14 Oil/Environment 1977: Long Term Recovery Potential of Cold Water Marine Environments after Oil Spills, Dartmouth, Nova Scotia, 1977.
Sponsored by Bedford Institute of Oceanography, Dartmouth, Nova Scotia.

Focus of the Symposium will be on invited papers concerning the 1969 West Falmouth spill and the 1970 Chedabucto Bay spill, with additional papers drawn from other similar studies. Topics to be considered include the following:

1. chemical alteration of stranded or sediment-bound oil;
2 degradation of stranded and sediment-bound oil by microbial and other means;
3. long-term fate of petroleum hydrocarbons in the marine system;
4. alteration of population and community structure after oiling;
5. physiological studies of chronically oiled marine organisms.

FFI contact Dr. John H. Vandermeulen, Oil/Environment 1977 programme coordinator, Marine Ecology Laboratory, Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada.

Master List of Keywords

S: See
SA: See also

Absorption
Activated sludge
Acute effects
Adriatic Sea
Adsorption
Aegean Sea
Africa
Alabama
Alaska
Alaska coast
Alaska, Gulf of
Algae ... SA: Phytoplankton
Analytical techniques ... SA: Chemical analysis; Source identification
Animals
Annelids ... SA: Polychaetes
Antarctica
API
Arabian Sea
Arctic
Arctic Ocean
Argentina
Argo Merchant Spill
Aromatic hydrocarbons ... SA: Hydrocarbons; PAH
Asia
Atlantic coast
Atlantic Ocean
Australia
Bacteria
Bahamas
Ballast
Baltic Sea
Bantry Bay
Barent Sea
Baseline studies
Beaches
Beaufort Sea
Behavior
Belgium
Bengal, Bay of
Benthos
Bering Sea
Bermuda coast
Bibliographies
Bilges
Biodegradation
Biological effects ... SA: Toxicity; Acute effects; Chronic effects
Biomass
Birds
Biscay, Bay of
Black Sea
BLM
Blowout prevention
Booms
Brazil
California
California coast
California, Southern
Canada
Carcinogens ... SA: Health hazards; PAH
Caribbean Sea
Caspian Sea
Chedabucto Bay
Chemical analysis ... SA: Analytical techniques; Source identification
Chemical effects
Chesapeake Bay
Chile
China
Chromatography
Chronic effects
Coagulation
Coalescence
Coasts
Colorado
Compensation
Connecticut
Conservation
Containment
Contaminants
Contamination
Contingency planning
Coral reefs
Cost analysis
Crankcase oil
Crude oil
Crustaceans
Decomposition
Delaware
Delaware Bay

Denmark
Design and engineering
Detection ... SA: Monitoring; Chemical analysis
Development ... SA: Offshore development
Dispersants
Dispersions
Disposal ... SA: Waste oil disposal; Wastewater disposal
Distillation
Distribution
Drift ... SA: Movement; Spreading
Drilling ... SA: Offshore drilling; Oil wells
East China Sea
Echinoderms
Economic effects
Economics
Ecosystems
Ecuador
Effluent treatment ... S: Wastewater treatment
EIS
Emulsification
Emulsifiers
Emulsions
Engineering ... S: Design and engineering
England
English Channel
Environmental deterioration
Environmental effects
Environmental Impact Statement ... S: EIS
Environmental management
Environmental protection
EPA
ERDA
Europe
Evaporation
Exploration ... SA: Offshore exploration; Production
Extraction
Fate
FEA
Filtration ... SA: Flocculation
Finland
Fish
Fisheries
Flocculation ... SA: Filtration
Florida
Florida coast
Flotation
Food web
Foreign governments
Fossil fuels
France
Freshwater
Fuel oil
Fuels
Fungi
Gas, liquid chromatography ... S: Chromatography
Gasoline
Georgia
Germany, East
Germany, West
Gibraltar, Strait of
Government agencies ... SA: U.S. Government, State governments
Great Lakes
Groundwater
Guidelines ... SA: Manuals
Habitat
Harbors
Health hazards ... SA: Carcinogens
Hydrocarbons ... SA: Aromatic hydrocarbons; Crude oil, PAH
Ice
IMCO
Incineration
India
Indian Ocean
Indonesia
Industries ... SA: Oil industry
Information systems
Infrared spectroscopy ... S: Spectroscopy
Inland
Insurance
International agreements
International conventions ... SA: Regulations; Legislation
Intertidal zone
Invertebrates
Iran
Iraq
Ireland
Israel

Italy
Japan
Japan, Sea of
Kentucky
Korea
Kuwait
Labrador Sea
Lakes ... SA: Great Lakes
Latin America
Law enforcement
Leakage
Legislation ... SA: Regulations; International conventions
Liability
Louisiana
Lubricating oil
Magellan, Strait of
Maine
Malaysia
Manuals ... SA: Guidelines
Marine mammals
Marine organisms
Marshes
Maryland
Massachusetts
Mass spectroscopy ... S: Spectroscopy
Mediterranean Sea
Metabolism
Metula spill
Mexico
Mexico, Gulf of
Michigan
Microorganisms ... SA: Algae; Bacteria; Fungi; Yeasts
Middle East
Mississippi
Mississippi River
Models
Mollusks
Monitoring ... SA: Detection; Remote sensing; Sampling
Movement ... SA: Spreading; Drift
Narraganset Bay
Natural seepage
Netherlands
Neuston
New Hampshire
New Jersey
New Mexico
New York
Niche
North Carolina
North Sea
North Vietnam
Norway
Norwegian Sea
Oceans
OCS
Offshore development
Offshore drilling
Offshore exploration
Offshore pipelines
Offshore production
Ohio
Oil ... S: Crude oil; Fuel oil; Lubricating oil; Crankcase oil; Waste oil
Oil discharges
Oil fields ... SA: Production
Oil-gas leasing
Oil industry
Oil shale
Oil slicks
Oil spills
Oil tanks
Oil transfer
Oil transport
Oil-water separation ... SA: Wastewater treatment
Oil wells ... SA: Drilling; Production; Offshore drilling; Offshore production
Okhotsk, Sea of
Onshore impacts
Oregon
Oxidation ... SA: Biodegradation; Weathering
Pacific Ocean
PAH
Patent
Pennsylvania
Personnel training
Petroleum ... S: Crude oil
Petroleum products
Petrochemicals
Petroleum industry ... S: Oil industry
pH control
Philippines
Physical effects
Phytoplankton
Pipelines ... SA: Offshore pipelines

Plankton ... SA: Phytoplankton; Zooplankton
Plants
Platforms
Poland
Pollution control
Pollution prevention ... SA: Environmental protection; Contingency planning
Polychaetes
Ports
Portugal
Precipitation
Production ... SA: Offshore production; Drilling; Offshore drilling
Prudhoe Bay
Puerto Rico
Puget Sound
Reclamation ... SA: Recycling; Reuse
Recycling ... SA: Reclamation; Reuse
Red Sea
Refineries
Refining
Regulations ... SA: Legislation; International conventions
Release
Remote Sensing ... SA: Monitoring; Detection
Resource management
Restoration
Reuse ... SA: Reclamation; Recycling
Rhine River
Rhode Island
Rivers
Ross Sea
Safety
Sampling ... SA: Monitoring; Detection
San Francisco Bay
Santa Barbara Channel
Sargasso Sea
Saudi Arabia
Scotland
Seawater
Sedimentation
Sediments
Segregated ballast
Ships ... SA: Tankers
Shorelines
Sinking agents
Skimmers
Sludge
Social effects
Socio-economic effects
Soil
Solid wastes
Solubility
Solution
Solvents
Source identification
Sources
South Africa
South Carolina
South China Sea
Spain
Spectrometry
Spectroscopy
Spill cleanup
Spill disposal
Spill recovery
Spreading ... SA: Movement; Drift
St. Lawrence River
Standing Crop
State Governments ... SA: U.S. Government; Government agencies
Statistical analysis
Statistics
Storage
Streams
Subarctic regions
Superports ... S: Ports
Supertankers ... S: Tankers
Surfactants
Surveillance
Sweden
Syria
Tankers ... SA: Ships
Tar
Tar sands
Texas
Torrey Canyon
Toxicity ... SA: Biological effects
Tropical regions
Turkey
UK
Uptake
U.S.
USCG
U.S. Government ... SA: State governments; Government agencies

USGS
USSR
Vegetation
Venezuela
Vietnam
Virginia
Virgin Islands
Wales
Washington
Waste oil
Waste oil disposal ... SA: Disposal
Waste oil treatment
Wastewaters
Wastewater disposal ... SA: Disposal
Wastewater treatment
Water quality
Weathering
Weddell Sea
West Indies
Wildlife
Yeasts
Yugoslavia
Zooplankton

SUBJECT INDEX

THE SUBJECT INDEX IS A PERMUTED INDEX THAT LISTS ALPHABETICALLY THE KEYWORDS AND CORRESPONDING CITATION INDEX NUMBER ASSIGNED TO EACH ABSTRACT IN SECTION I (EACH INDEX NUMBER APPEARS IN THE FORM C-____-77). THESE KEYWORDS ARE SELECTED FROM THE MASTER LIST, P. 256. FREE LANGUAGE TERMS WHICH ARE INCLUDED TO GIVE MORE SPECIFIC INFORMATION ABOUT AN ENTRY ARE PRECEDED BY A * SIGN IN THE SUBJECT INDEX.

1137 ABSORPTION, SPILL CONTAINMENT, SPILL RECOVERY, *SORBENT PADS,
1138 ABSORPTION, SPILL CONTAINMENT, BOOMS, DESIGN-ENGINEERING, HYDROCARBONS, PATENT,
1141 ABSORPTION, SPILL RECOVERY, DESIGN-ENGINEERING, *FERROMAGNETIC FOAM,
1154 ABSORPTION, SKIMMERS, SPILL RECOVERY, DESIGN-ENGINEERING,
1165 ABSORPTION, SPILL RECOVERY, DESIGN-ENGINEERING, PATENT, *SORBENT BROADCASTER,
1168 ABSORPTION, SPILL CLEANUP, DISPOSAL , *COTTON SORBENT,
1171 ABSORPTION, SPILL RECOVERY, PATENT, *GLASS FIBER BLANKETS,
1176 ABSORPTION, SPILL RECOVERY, PATENT, *ABSORBENT POLYMERS,
1177 ABSORPTION, SPILL RECOVERY, SKIMMERS, PATENT, *ABSORBENT POWDER,
1182 ABSORPTION, SPILL CLEANUP, WASTE OIL, RIVERS, SEAWATER, PATENT,
1185 ABSORPTION, CRUDE OIL, SPILL RECOVERY, DESIGN-ENGINEERING, *SORBENTS,
1191 ABSORPTION, EMULSIONS, PATENT, *POLYURETHANE FOAM CHIPS,
1249 ABSORPTION, WASTEWATER TREATMENT, INDUSTRIES, CONTAMINANTS, *PEAT MOSS,
1282 ABSORPTION, WASTEWATER TREATMENT, AROMATIC HYDROCARBONS, PETROCHEMICALS,
1283 ABSORPTION, WASTEWATER TREATMENT, OIL SLICKS, SPILL RECOVERY, PATENT, *POLYURETHANE,
1296 ABSORPTION, WASTEWATER TREATMENT, *COAL ASH,
1307 ABSORPTION, WASTEWATER TREATMENT, FILTRATION, *POWDERED STEEL-MELTING SLAG,
1573 ABSORPTION, OIL SPILLS, SPREADING, ICE, SOLUBILITY, BEHAVIOR, CLEANUP, ARCTIC,
1106 ACTIVATED SLUDGE, HYDROCARBONS, DECOMPOSITION, CHEMICAL ANALYSIS, CHROMATOGRAPHY,
1262 ACTIVATED SLUDGE, WASTE OIL TREATMENT, PETROLEUM PRODUCTS,
1272 ACTIVATED SLUDGE, WASTEWATER TREATMENT, REFINERIES, OXIDATION, PATENT,
1289 ACTIVATED SLUDGE, WASTEWATERS, REFINERIES, SOURCES, WASTEWATER TREATMENT, *OXIDATION LAGOONS, *ACTIVATED CARBON,
1368 ACUTE EFFECTS, CRUDE OIL, TOXICITY, CRUSTACEANS, CHRONIC EFFECTS, ALASKA, *CANCER MAGISTER DANA, *WATER SOLUBLE FRACTION,
1369 ACUTE EFFECTS, CRUDE OIL, TOXICITY, CORALS, RED SEA, *HETEROXENIA FUSCESCENS,
1370 ACUTE EFFECTS, HYDROCARBONS, TOXICITY, FISH, CHRONIC EFFECTS, BERING SEA, ALASKA,
1373 ACUTE EFFECTS, MARINE MAMMALS, TOXICITY, HYDROCARBONS, *SEALS, *PHOCA VITULINA,
1384 ACUTE EFFECTS, CRUDE OIL, CONTAMINATION, BIRDS, WILDLIFE, CHRONIC EFFECTS,
1390 ACUTE EFFECTS, TOXICITY, FUEL OIL, BEHAVIOR, ZOOPLANKTON, *WATER SOLUBLE FRACTIONS,
1398 ACUTE EFFECTS, TOXICITY, WASTEWATERS, REFINERIES, FRESHWATER, FISH, *REDEAR SUNFISH,
1399 ACUTE EFFECTS, HYDROCARBONS, TOXICITY, FISH, *FATHEAD MINNOWS,
1414 ACUTE EFFECTS, CRUDE OIL, TOXICITY, MARINE ORGANISMS, CHRONIC EFFECTS, METABOLISM, ALASKA,
1419 ACUTE EFFECTS, CRUDE OIL, TOXICITY, FISH, FISHERIES, OFFSHORE DEVELOPMENT, ALASKA/GULF OF, *PACIFIC HERRING,
1420 ACUTE EFFECTS, TOXICITY, CRUDE OIL, MARINE MAMMALS, *RINGED SEALS,
1424 ACUTE EFFECTS, FUEL OIL, OIL SPILLS, TOXICITY, MOLLUSKS, CHRONIC EFFECTS, INTERTIDAL ZONE, *HONG KONG,
1433 ACUTE EFFECTS, DISPERSANTS, TOXICITY, FISH, SOLVENTS, *FISH LARVAE,
1504 ACUTE EFFECTS, DRILLING, OIL WELLS, TOXICITY, FISH, ARCTIC, *TROUT, *DRILLING MUDS,
1505 ACUTE EFFECTS, MONITORING, MARINE ORGANISMS, DISTRIBUTION, INTERTIDAL ZONE, COASTS, CHRONIC EFFECTS, BERING SEA, ALASKA/GULF OF, BASELINE STUDIES,
1561 ACUTE EFFECTS, BIODEGRADATION, CRUDE OIL, BACTERIA, UPTAKE, METABOLISM, BEAUFORT SEA, ALASKA/GULF OF, BASELINE STUDIES,
1595 ACUTE EFFECTS, OIL DISCHARGES, FATE, BIOLOGICAL EFFECTS, CHRONIC EFFECTS, MARINE ORGANISMS, NORTH SEA,
1139 ADSORPTION, SPILL CONTAINMENT, BOOMS, HYDROCARBONS, DESIGN-ENGINEERING, PATENT,
1163 ADSORPTION, SPILL RECOVERY, PATENT,
1192 ADSORPTION, PATENT, *POLYURETHANE FOAM,
1284 ADSORPTION, WASTEWATER TREATMENT, PETROCHEMICALS, FILTRATION,
1065 ALABAMA, SAMPLING, HYDROCARBONS, SEDIMENTS, OCS, ESTUARIES, OIL SPILLS, TOXICITY, MISSISSIPPI,
1038 ALASKA , MONITORING, *STREAMFLOW, ESTUARIES, COASTS, OFFSHORE DEVELOPMENT, OIL SPILLS, ENVIRONMENTAL EFFECTS, BASELINE STUDIES,
1059 ALASKA , MONITORING, *WIND CONDITIONS, OFFSHORE DEVELOPMENT, FATE, CONTAMINANTS, COASTS, BASELINE STUDIES,
1062 ALASKA , MONITORING, HYDROCARBONS, DISTRIBUTION, FATE, OCS, BASELINE STUDIES,
1063 ALASKA , MONITORING, CRUDE OIL, SEDIMENTS, UPTAKE, RELEASE, INTERTIDAL ZONE, *PORT VALDEZ,
1072 ALASKA , REMOTE SENSING, OCS, OFFSHORE DEVELOPMENT, FATE, OIL SPILLS, ENVIRONMENTAL EFFECTS, CONTINGENCY PLANNING,
1218 ALASKA , OIL TRANSPORT, OIL SPILLS, TANKERS, ENVIRONMENTAL EFFECTS, *VALDEZ NARROWS,
1224 ALASKA , OIL TRANSPORT, TANKERS, PORTS, OIL SPILLS, ENVIRONMENTAL EFFECTS, *VALDEZ NARROWS,

ZONE, COASTS, CHRONIC EFFECTS, BERING SEA, BASELINE STUDIES,
1546 ALASKA/GULF OF, BIODEGRADATION, HYDROCARBONS, MICROORGANISMS, OFFSHORE DEVELOPMENT, OCS, BASELINE STUDIES,
1561 ALASKA/GULF OF, ACUTE EFFECTS, BIODEGRADATION, CRUDE OIL, BACTERIA, UPTAKE, METABOLISM, BEAUFORT SEA, BASELINE STUDIES,
1566 ALASKA/GULF OF, BIODEGRADATION, OIL SLICKS, BACTERIA, NEUSTON, BLACK SEA, CASPIAN SEA, *AZOV SEA,
1588 ALASKA/GULF OF, OIL SPILLS, MOVEMENT, OFFSHORE DRILLING, BASELINE STUDIES, *OCEAN CIRCULATION,
1591 ALASKA/GULF OF, OFFSHORE DEVELOPMENT, OIL SPILLS, FATE, OCS, BASELINE STUDIES, *OCEAN CIRCULATION, *FLOW TRAJECTORIES,
1632 ALASKA/GULF OF, BIBLIOGRAPHIES, FISH, *NON-SALMONID PELAGIC FISHES, BERING SEA, BASELINE STUDIES,
1348 ALGAE, ICE, PHYTOPLANKTON, BEAUFORT SEA, *PRIMARY PRODUCTIVITY, *OIL-UNDER-ICE,
1356 ALGAE, ALASKA, PLANTS, *LICHENS, BIOLOGICAL EFFECTS, CRUDE OIL, ARCTIC,
1360 ALGAE, METULA SPILL, BIOLOGICAL EFFECTS, BIRDS, MOLLUSKS, FISHERIES, MAGELLAN/STRAIT OF,
1404 ALGAE, BIOLOGICAL EFFECTS, METABOLISM, UPTAKE, *PHOTOSYNTHESIS, *RESPIRATION,
1429 ALGAE, HYDROCARBONS, BIOLOGICAL EFFECTS, METABOLISM, *NAPHTHALENE,
1434 ALGAE, TOXICITY, FUEL OIL, *GROWTH RATES, *PHENALEN-1-ONE,
1627 ALGAE, BIBLIOGRAPHIES, BIODEGRADATION, OIL SPILLS, HYDROCARBONS, BACTERIA, SPILL CLEANUP,
1049 ANALYTICAL TECHNIQUES, MONITORING, SPECTROMETRY, DETECTION, BILGES, BALLAST, WASTE OIL, *SUMMING LUMINESCENCE SPECTROMETRY,
1054 ANALYTICAL TECHNIQUES, MONITORING, HYDROCARBONS, MARINE ORGANISMS, UPTAKE, METABOLISM,
1090 ANALYTICAL TECHNIQUES, WASTEWATERS, REFINERIES, MONITORING, TOXICITY,
1094 ANALYTICAL TECHNIQUES, HYDROCARBONS, MARINE ORGANISMS, SEDIMENTS, CHROMATOGRAPHY, SPECTROSCOPY, PUGET SOUND, WASHINGTON,
1096 ANALYTICAL TECHNIQUES, WATER QUALITY, POLLUTION CONTROL, OIL INDUSTRY, WASTEWATERS, SAMPLING, *ON-LINE INSTRUMENTATION,
1101 ANALYTICAL TECHNIQUES, CONTAMINANTS, HYDROCARBONS, AROMATIC HYDROCARBONS, *WATER POLLUTANTS,
1105 ANALYTICAL TECHNIQUES, PETROLEUM PRODUCTS, *GRAVIMETRIC DETERMINATION, SOLVENTS, EXTRACTION,
1111 ANALYTICAL TECHNIQUES, CONTAMINANTS, SPECTROMETRY, *POLLUTANT CLASSIFICATION, *COMPUTER-SPECTROMETER SYSTEM,
1112 ANALYTICAL TECHNIQUES, PETROLEUM PRODUCTS, DETECTION, SEAWATER, *NAPHTHENIC ACIDS,
1113 ANALYTICAL TECHNIQUES, WASTE OIL, PETROCHEMICALS, INDUSTRIES, *X-RAY FLUORESCENCE,
1116 ANALYTICAL TECHNIQUES, CONTAMINANTS, HYDROCARBONS, COASTS, GERMANY, EAST, *SPECTROPHOTOMETRY, *COLORIMETRY,
1117 ANALYTICAL TECHNIQUES, PAH, LAKES, SEDIMENTS, CHROMATOGRAPHY, SPECTROMETRY,
1121 ANALYTICAL TECHNIQUES, AROMATIC HYDROCARBONS, CHROMATOGRAPHY, SPECTROSCOPY, SEDIMENTS, LAKES, *FLUORESCENCE,
1125 ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, CRUDE OIL, *LUMINESCENCE CONTOUR SPECTRA,
1129 ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, CHROMATOGRAPHY, *TAR BALLS, SAMPLING, CRUDE OIL, WEATHERING, ISRAEL, MEDITERRANEAN SEA,
1130 ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, OIL SPILLS, CRUDE OIL, CHROMATOGRAPHY, SPECTROSCOPY, SPECTROMETRY, *US BUREAU OF MINES,
1417 ANALYTICAL TECHNIQUES, HYDROCARBONS, BIOLOGICAL EFFECTS, MARINE ORGANISMS, *SPIN-LABELING TECHNIQUES,
1465 ANIMALS, OIL SLICKS, BIOLOGICAL EFFECTS, PHYSICAL EFFECTS, PLANTS, *OXYGEN EXCHANGE, *TEMPERATURE, *LIGHT REDUCTION, *ROCK POOLS,
1119 API, CRUDE OIL, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION,
1353 API, CRUDE OIL, MARINE ORGANISMS, BIOLOGICAL EFFECTS, PLATFORMS, NATURAL SEEPAGE, CHRONIC EFFECTS,
1400 API, CRUDE OIL, MARINE ORGANISMS, BIOLOGICAL EFFECTS, PLATFORMS, NATURAL SEEPAGE, CHRONIC EFFECTS,
1468 API, OFFSHORE PRODUCTION, PLATFORMS, ENVIRONMENTAL EFFECTS, MARINE ORGANISMS, NATURAL SEEPAGE,
1142 ARCTIC, OIL WELLS, *BLOWOUTS, SPILL DISPOSAL, INCINERATION, ICE, CANADA,
1188 ARCTIC, SPILL RECOVERY, SKIMMERS, CRUDE OIL, FRESHWATER, ICE, *LOCKHEED CLEAN SWEEP,
1204 ARCTIC, OIL TRANSFER, SHIPS, *PUMPS, DESIGN-ENGINEERING, *ADAPTS,
1340 ARCTIC, SPILL CLEANUP, DISPOSAL , BEHAVIOR, DETECTION, *ARCTIC MARINE OIL SPILL PROGRAM,
1356 ARCTIC, ALGAE, ALASKA, PLANTS, *LICHENS, BIOLOGICAL EFFECTS, CRUDE OIL,
1376 ARCTIC, ALASKA, OIL SPILLS, ENVIRONMENTAL EFFECTS, MARINE ORGANISMS, *PRUDHOE BAY,
1409 ARCTIC, CRUDE OIL, CRUSTACEANS, BIOLOGICAL EFFECTS, SEDIMENTS, BENTHOS, *AMPHIPODS, *ISOPODS,
1410 ARCTIC, CRUDE OIL, MARINE ORGANISMS, INVERTEBRATES, BIOLOGICAL EFFECTS, BEHAVIOR, METABOLISM,
1411 ARCTIC, TOXICITY, CRUDE OIL, INVERTEBRATES, *AMPHIPOD, *COELENTERATE,
1504 ARCTIC, ACUTE EFFECTS, DRILLING, OIL WELLS, TOXICITY, FISH, *TROUT, *DRILLING MUDS,
1523 ARCTIC, OFFSHORE DRILLING, SPILL CLEANUP, ICE, BASELINE STUDIES, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, BEAUFORT SEA,
1547 ARCTIC, BIODEGRADATION, CRUDE OIL, PETROLEUM PRODUCTS, TOXICITY, CRUSTACEANS,

1225 ALASKA, SPILL DISPOSAL, STORAGE, CRUDE OIL, FUEL OIL,
1227 ALASKA, PIPELINES, DEVELOPMENT, ENVIRONMENTAL EFFECTS, OIL SPILLS, LEGISLATION, LIABILITY,
1356 ALASKA, PLANTS, *LICHENS, ALGAE, BIOLOGICAL EFFECTS, CRUDE OIL, ARCTIC,
1368 ALASKA, ACUTE EFFECTS, CRUDE OIL, TOXICITY, CRUSTACEANS, CHRONIC EFFECTS, *CANCER MAGISTER DANA, *WATER SOLUBLE FRACTION,
1370 ALASKA, ACUTE EFFECTS, HYDROCARBONS, TOXICITY, FISH, CHRONIC EFFECTS, BERING SEA,
1376 ALASKA, OIL SPILLS, ENVIRONMENTAL EFFECTS, MARINE ORGANISMS, ARCTIC, *PRUDHOE BAY,
1378 ALASKA, OIL SPILLS, BIOLOGICAL EFFECTS, MARINE MAMMALS, METABOLISM, *PHYSIOLOGY, *PINNIPEDS,
1395 ALASKA, CRUDE OIL, TOXICITY, FISH, *LIVER AND SKIN TISSUES,
1396 ALASKA, HYDROCARBONS, BIOLOGICAL EFFECTS, FISH, CRUSTACEANS, UPTAKE, RELEASE, *BIOTRANSFORMATION,
1414 ALASKA, ACUTE EFFECTS, CRUDE OIL, TOXICITY, MARINE ORGANISMS, CHRONIC EFFECTS, METABOLISM,
1415 ALASKA, CRUDE OIL, FUEL OIL, HYDROCARBONS, FISH, *RESPIRATION RATE, *ONCORHYNCHUS GORBUSCHA,
1426 ALASKA, CRUDE OIL, BIOLOGICAL EFFECTS, MOLLUSKS, SEDIMENTS, *CLAMS, *INDICATOR SPECIES, *MACOMA BALTHICA,
1447 ALASKA, OFFSHORE DEVELOPMENT, ONSHORE IMPACTS, MODELS,
1470 ALASKA, OIL FIELDS, DEVELOPMENT, COASTS, BIRDS, ENVIRONMENTAL PROTECTION, PRUDHOE BAY, *TUNDRA WETLANDS,
1491 ALASKA, BENTHOS, SEDIMENTS, MONITORING, OCS, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, BASELINE STUDIES,
1501 ALASKA, MARINE MAMMALS, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, DISTRIBUTION, *SEA OTTERS, BASELINE STUDIES,
1502 ALASKA, MARINE MAMMALS, DISTRIBUTION, CONTAMINATION, HABITAT, OFFSHORE DEVELOPMENT, *SEA OTTERS,
1520 ALASKA, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, OIL SPILLS, OCS, *GEOLOGY, *HYDROLOGY, *YUKON DELTA,
1533 ALASKA, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, OCS, BASELINE STUDIES, MARINE ORGANISMS, BIRDS,
1534 ALASKA, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, OCS, BASELINE STUDIES,
1541 ALASKA, OFFSHORE DEVELOPMENT, SOCIAL EFFECTS, ECONOMIC EFFECTS,
1574 ALASKA, OIL SPILLS, ICE, COASTS, ARCTIC OCEAN, *OIL-ICE INTERACTION,
1590 ALASKA, MODELS, *CIRCULATION, OCS, OIL SPILLS, FATE, BASELINE STUDIES, *TRAJECTORY ANALYSIS,
1597 ALASKA, *OCEAN CIRCULATION, OCS, FATE, CONTAMINANTS, OFFSHORE DEVELOPMENT, BASELINE STUDIES,
1047 ALASKA/GULF OF, MONITORING, OCEANS, *CIRCULATION PATTERNS, OCS, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS,
1060 ALASKA/GULF OF, MONITORING, *OCEAN CURRENTS, FATE, CONTAMINANTS, OFFSHORE DEVELOPMENT, BASELINE STUDIES,
1061 ALASKA/GULF OF, MONITORING, *MARINE CLIMATOLOGY, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, BERING SEA, BEAUFORT SEA, BASELINE STUDIES,
1207 ALASKA/GULF OF, OIL TRANSPORT, OCS, OIL SPILLS, ECONOMICS, STORAGE, TANKERS, PIPELINES, OIL TANKS, *RISK ANALYSIS,
1350 ALASKA/GULF OF, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, OIL SPILLS, *PRIMARY PRODUCTION, FOOD WEB, BASELINE STUDIES,
1387 ALASKA/GULF OF, OIL SPILLS, BIOLOGICAL EFFECTS, OCS, MOLLUSKS, HABITAT, OFFSHORE DEVELOPMENT, *CLAMS, BASELINE STUDIES,
1419 ALASKA/GULF OF, ACUTE EFFECTS, CRUDE OIL, TOXICITY, FISH, FISHERIES, OFFSHORE DEVELOPMENT, *PACIFIC HERRING,
1475 ALASKA/GULF OF, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, MARINE MAMMALS, DISTRIBUTION, *SEA LIONS, *ECOLOGY, *TROPHIC STRUCTURE,
1480 ALASKA/GULF OF, ZOOPLANKTON, MONITORING, DISTRIBUTION, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS, BASELINE STUDIES,
1481 ALASKA/GULF OF, MONITORING, DISTRIBUTION, PLANKTON, *ICHTHYOPLANKTON, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS, BASELINE STUDIES,
1484 ALASKA/GULF OF, BENTHOS, DISTRIBUTION, *PRODUCTIVITY, BERING SEA, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS,
1485 ALASKA/GULF OF, MONITORING, BENTHOS, DISTRIBUTION, *PRODUCTIVITY, STATISTICAL ANALYSIS, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS, BASELINE STUDIES,
1487 ALASKA/GULF OF, MARINE MAMMALS, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, DISTRIBUTION, BASELINE STUDIES,
1497 ALASKA/GULF OF, MONITORING, FISH, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, BERING SEA, BEAUFORT SEA, BASELINE STUDIES, *FISH DISEASES,
1499 ALASKA/GULF OF, FISHERIES, FISH, *SHELLFISH, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS, BASELINE STUDIES, *DEMERSAL RESOURCES,
1500 ALASKA/GULF OF, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, MARINE MAMMALS, CONTAMINANTS, FOOD WEB, *ECOLOGY, *HARBOR SEAL,
1503 ALASKA/GULF OF, FISH, FOOD WEB, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, BERING SEA, BASELINE STUDIES,
1505 ALASKA/GULF OF, ACUTE EFFECTS, MONITORING, MARINE ORGANISMS, DISTRIBUTION, INTERTIDAL

MONITORING, *AMPHIPODS,
1573 ARCTIC, ABSORPTION, OIL SPILLS, SPREADING, ICE, SOLUBILITY, BEHAVIOR, CLEANUP,
1594 ARCTIC, CRUDE OIL, ICE, MONITORING, SPREADING, MOVEMENT, WEATHERING, SPILL CLEANUP,
1624 ARCTIC, BIBLIOGRAPHIES, OIL SLICKS, CONTAINMENT, RECOVERY, OIL TRANSFER, STORAGE, SPILL DISPOSAL, BIODEGRADATION, ICE,
1629 ARCTIC, BIBLIOGRAPHIES, OIL SPILLS, MARINE ORGANISMS, BIOLOGICAL EFFECTS, SUBARCTIC REGIONS, BASELINE STUDIES,
1574 ARCTIC OCEAN, ALASKA, OIL SPILLS, ICE, COASTS, *OIL-ICE INTERACTION,
1013 ARGO MERCHANT SPILL, ENVIRONMENTAL EFFECTS, FISHERIES, OLYMPIC GAMES SPILL,
1014 ARGO MERCHANT SPILL, OIL SPILLS, TANKERS, *LIBERIAN REGISTRY,
1022 ARGO MERCHANT SPILL, TANKERS, ENVIRONMENTAL EFFECTS, FISHERIES, SPILL CLEANUP, LIABILITY,
1025 ARGO MERCHANT SPILL, ENVIRONMENTAL EFFECTS, TANKERS, *LIBERIAN FLAG OF CONVENIENCE,
1027 ARGO MERCHANT SPILL, TANKERS, LEGISLATION, FISHERIES, USCG, *NEW ENGLAND,
1226 ARGO MERCHANT SPILL, TANKERS, SAFETY, CONTINGENCY PLANNING, LIABILITY, USCG, MEXICO/GULF OF, *FLAGS OF CONVENIENCE,
1444 ARGO MERCHANT SPILL, FATE, ATLANTIC OCEAN, BIOLOGICAL EFFECTS, MARINE ORGANISMS,
1524 ARGO MERCHANT SPILL, OIL-GAS LEASING, ATLANTIC OCEAN, EIS, ENVIRONMENTAL EFFECTS, FISHERIES, BLM, *GEORGES BANK,
1579 ARGO MERCHANT SPILL, FUEL OIL, BIOLOGICAL EFFECTS, FATE, MARINE ORGANISMS, CONTAMINATION, NOAA, ATLANTIC OCEAN,
1581 ARGO MERCHANT SPILL, FUEL OIL, FATE, CONTAMINATION, MARINE ORGANISMS, FISHERIES, MODELS, MOVEMENT, NOAA, ATLANTIC OCEAN,
1067 AROMATIC HYDROCARBONS, MONITORING, WASTEWATERS, REFINERIES, CHEMICAL ANALYSIS, *COLORIMETRY,
1101 AROMATIC HYDROCARBONS, ANALYTICAL TECHNIQUES, CONTAMINANTS, HYDROCARBONS, *WATER POLLUTANTS,
1107 AROMATIC HYDROCARBONS, CARCINOGENS, CHEMICAL ANALYSIS, CONTAMINANTS, *ORGANIC POLLUTANTS,
1121 AROMATIC HYDROCARBONS, ANALYTICAL TECHNIQUES, CHROMATOGRAPHY, SPECTROSCOPY, SEDIMENTS, LAKES, *FLUORESCENCE,
1282 AROMATIC HYDROCARBONS, ABSORPTION, WASTEWATER TREATMENT, PETROCHEMICALS,
1367 AROMATIC HYDROCARBONS, BACTERIA, TOXICITY, BIOLOGICAL EFFECTS,
1416 AROMATIC HYDROCARBONS, FUEL OIL, POLYCHAETES, UPTAKE, RELEASE, *NAPHTHALENE, *NEANTHES ARENACEODENTATA,
1567 AROMATIC HYDROCARBONS, BIODEGRADATION, MICROORGANISMS, BACTERIA, SEDIMENTS, CHESAPEAKE BAY,
1082 ATLANTIC COAST, SAMPLING, MICROORGANISMS, DISTRIBUTION, SEAWATER, SEDIMENTS, OFFSHORE DRILLING, BIOLOGICAL EFFECTS,
1355 ATLANTIC COAST, OIL SPILLS, ENVIRONMENTAL EFFECTS, SHORELINES, *WWII SPILLS,
1386 ATLANTIC COAST, OIL SPILLS, WWII SPILLS, TANKERS, ENVIRONMENTAL EFFECTS, MOVEMENT,
1515 ATLANTIC COAST, OFFSHORE DEVELOPMENT, OIL INDUSTRY, OIL WELLS, OCS, ENVIRONMENTAL EFFECTS,
1539 ATLANTIC COAST, OIL SPILLS, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, *RISK ANALYSIS,
1563 ATLANTIC COAST, BIODEGRADATION, CRUDE OIL, MICROORGANISMS, SAMPLING, OFFSHORE DRILLING, *OIL DEVELOPMENT SITES,
1596 ATLANTIC COAST, FATE, OIL TRANSPORT, OCS, EIS, *SUSPENDED MATTER,
1087 ATLANTIC OCEAN, SAMPLING, TAR, CARIBBEAN SEA,
1444 ATLANTIC OCEAN, ARGO MERCHANT SPILL, FATE, BIOLOGICAL EFFECTS, MARINE ORGANISMS,
1478 ATLANTIC OCEAN, OFFSHORE PRODUCTION, EIS, OCS, BIOLOGICAL EFFECTS, *GEORGES BANK,
1524 ATLANTIC OCEAN, ARGO MERCHANT SPILL, OIL-GAS LEASING, EIS, ENVIRONMENTAL EFFECTS, FISHERIES, BLM, *GEORGES BANK,
1554 ATLANTIC OCEAN, BIODEGRADATION, CRUDE OIL, HYDROCARBONS, MICROORGANISMS, SAMPLING,
1579 ATLANTIC OCEAN, ARGO MERCHANT SPILL, FUEL OIL, BIOLOGICAL EFFECTS, FATE, MARINE ORGANISMS, CONTAMINATION, NOAA,
1581 ATLANTIC OCEAN, ARGO MERCHANT SPILL, FUEL OIL, FATE, CONTAMINATION, MARINE ORGANISMS, FISHERIES, MODELS, MOVEMENT, NOAA,
1102 BACTERIA, HYDROCARBONS, SEDIMENTS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, PETROLEUM PRODUCTS, BIODEGRADATION, COASTS, FLORIDA,
1263 BACTERIA, OIL WELLS, DRILLING, WASTEWATER TREATMENT, BIODEGRADATION, FLOCCULATION, PATENT,
1367 BACTERIA, AROMATIC HYDROCARBONS, TOXICITY, BIOLOGICAL EFFECTS,
1382 BACTERIA, CRUDE OIL, *REFINED OIL, TOXICITY, METABOLISM, MARINE ORGANISMS, WEATHERING,
1385 BACTERIA, TOXICITY, CRUDE OIL, FUEL OIL, COASTS, CANADA, *GLUCOSE UPTAKE,
1392 BACTERIA, REFINERIES, WASTEWATERS, BIODEGRADATION, ENVIRONMENTAL EFFECTS, MARINE ORGANISMS, PHYTOPLANKTON, FRANCE,
1548 BACTERIA, BIODEGRADATION, HYDROCARBONS, *LYSIS, *IONIC CONCENTRATION,
1549 BACTERIA, BIODEGRADATION, HYDROCARBONS, OXIDATION, TOXICITY, SURFACTANTS, *IONIC CONCENTRATION, *DETERGENTS,
1550 BACTERIA, BIODEGRADATION, HYDROCARBONS, COASTS, MONITORING,
1551 BACTERIA, BIODEGRADATION, OIL SLICKS, SPILL CLEANUP, DESIGN-ENGINEERING, PATENT,
1555 BACTERIA, BIODEGRADATION, HYDROCARBONS, NARRAGANSETT BAY, *GROWTH STUDIES,
1558 BACTERIA, BIODEGRADATION, HYDROCARBONS, METABOLISM,
1560 BACTERIA, BIODEGRADATION, COASTS, *COASTAL WATERS, SEDIMENTS, BLACK SEA, USSR,

1561 BACTERIA, ALASKA/GULF OF, ACUTE EFFECTS, BIODEGRADATION, CRUDE OIL, UPTAKE, METABOLISM, BEAUFORT SEA, BASELINE STUDIES,
1562 BACTERIA, BIODEGRADATION, OIL SPILLS, FATE, EMULSIFICATION, DISPERSIONS, WEATHERING,
1564 BACTERIA, BIODEGRADATION, OIL SPILLS, PETROLEUM PRODUCTS,
1565 BACTERIA, BIODEGRADATION, HYDROCARBONS, METABOLISM, ESTUARIES, *CYCLOHEXANE,
1566 BACTERIA, ALASKA/GULF OF, BIODEGRADATION, OIL SLICKS, NEUSTON, BLACK SEA, CASPIAN SEA, *AZOV SEA,
1567 BACTERIA, AROMATIC HYDROCARBONS, BIODEGRADATION, MICROORGANISMS, SEDIMENTS, CHESAPEAKE BAY,
1568 BACTERIA, BIODEGRADATION, CRUDE OIL, MICROORGANISMS, ESTUARIES,
1627 BACTERIA, ALGAE, BIBLIOGRAPHIES, BIODEGRADATION, OIL SPILLS, HYDROCARBONS, SPILL CLEANUP,
1033 BALLAST, MONITORING, OIL SLICKS, POLLUTION PREVENTION, TANKERS, *OIL-WATER INTERFACE,
1036 BALLAST, MONITORING, OIL DISCHARGES, BILGES, SHIPS,
1039 BALLAST, MONITORING, HYDROCARBONS, PETROLEUM PRODUCTS, WASTEWATERS, PATENT, *SOUND VELOCITY CHARACTERISTICS,
1042 BALLAST, MONITORING, OIL SLICKS, TANKERS, DESIGN-ENGINEERING, PATENT,
1049 BALLAST, ANALYTICAL TECHNIQUES, MONITORING, SPECTROMETRY, DETECTION, BILGES, WASTE OIL, *SUMMING LUMINESCENCE SPECTROMETRY,
1026 BALTIC SEA, ENVIRONMENTAL PROTECTION, UK, USSR, *JOINT UK/USSR COMMITTEE,
1057 BALTIC SEA, MONITORING, PETROLEUM PRODUCTS, NORTH SEA, NORWEGIAN SEA,
1073 BALTIC SEA, REMOTE SENSING, CONTAMINANTS, *WIND EFFECTS, *WAVE EFFECTS,
1379 BALTIC SEA, BIRDS, CONTAMINATION, STATISTICS, *MORTALITY,
1425 BALTIC SEA, CRUDE OIL, BIRDS, CONTAMINATION, STATISTICS, *MORTALITY, *GDANSK BAY,
1452 BALTIC SEA, ECOSYSTEMS, CONTAMINANTS, HYDROCARBONS, ENVIRONMENTAL EFFECTS,
1031 BASELINE STUDIES, MONITORING, *OCEAN CURRENTS, OCS, OFFSHORE DEVELOPMENT, FATE, CONTAMINANTS, BEAUFORT SEA,
1034 BASELINE STUDIES, MONITORING, CONTAMINANTS, HYDROCARBONS, COASTS, MEDITERRANEAN SEA, *POLLUTANT TRANSPORT,
1035 BASELINE STUDIES, MONITORING, SEDIMENTS, MOLLUSKS, PUGET SOUND, ENVIRONMENTAL EFFECTS, OIL SPILLS, NOAA,
1038 BASELINE STUDIES, ALASKA, MONITORING, *STREAMFLOW, ESTUARIES, COASTS, OFFSHORE DEVELOPMENT, OIL SPILLS, ENVIRONMENTAL EFFECTS,
1040 BASELINE STUDIES, MONITORING, HYDROCARBONS, DISTRIBUTION, OCS, OFFSHORE DEVELOPMENT, BERING SEA, *NATURALLY-OCCURRING HYDROCARBONS,
1043 BASELINE STUDIES, MONITORING, MARINE ORGANISMS, OFFSHORE DEVELOPMENT, NORTH SEA, *CELTIC SEA,
1059 BASELINE STUDIES, ALASKA, MONITORING, *WIND CONDITIONS, OFFSHORE DEVELOPMENT, FATE, CONTAMINANTS, COASTS,
1060 BASELINE STUDIES, ALASKA/GULF OF, MONITORING, *OCEAN CURRENTS, FATE, CONTAMINANTS, OFFSHORE DEVELOPMENT,
1061 BASELINE STUDIES, ALASKA/GULF OF, MONITORING, *MARINE CLIMATOLOGY, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, BERING SEA, BEAUFORT SEA,
1062 BASELINE STUDIES, ALASKA, MONITORING, HYDROCARBONS, DISTRIBUTION, FATE, OCS,
1350 BASELINE STUDIES, ALASKA/GULF OF, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, OIL SPILLS, *PRIMARY PRODUCTION, FOOD WEB,
1387 BASELINE STUDIES, ALASKA/GULF OF, OIL SPILLS, BIOLOGICAL EFFECTS, OCS, MOLLUSKS, HABITAT, OFFSHORE DEVELOPMENT, *CLAMS,
1464 BASELINE STUDIES, OIL SPILLS, ENVIRONMENTAL EFFECTS, COASTS, *COASTAL IMPACTS,
1467 BASELINE STUDIES, MONITORING, PHYTOPLANKTON, ICE, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS, FOOD WEB, BERING SEA,
1469 BASELINE STUDIES, MONITORING, ESTUARIES, FISHERIES, DISTRIBUTION, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS, BEAUFORT SEA,
1471 BASELINE STUDIES, MONITORING, HABITAT, MARINE ORGANISMS, COASTS, BEAUFORT SEA, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS,
1473 BASELINE STUDIES, MARINE MAMMALS, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, DISTRIBUTION, BERING SEA, *SPOTTED SEAL,
1474 BASELINE STUDIES, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, MARINE MAMMALS, HABITAT, ICE, DISTRIBUTION, BERING SEA, BEAUFORT SEA,
1477 BASELINE STUDIES, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, BENTHOS, DISTRIBUTION, BEAUFORT SEA,
1479 BASELINE STUDIES, ZOOPLANKTON, *MICRONEKTON, DISTRIBUTION, OFFSHORE DEVELOPMENT, BERING SEA, BEAUFORT SEA,
1480 BASELINE STUDIES, ALASKA/GULF OF, ZOOPLANKTON, MONITORING, DISTRIBUTION, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS,
1481 BASELINE STUDIES, ALASKA/GULF OF, MONITORING, DISTRIBUTION, PLANKTON, *ICHTHYOPLANKTON, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS,
1482 BASELINE STUDIES, MONITORING, PLANKTON, DISTRIBUTION, BEAUFORT SEA, BIBLIOGRAPHIES,
1483 BASELINE STUDIES, MARINE MAMMALS, TOXICITY, OFFSHORE DEVELOPMENT, BERING SEA, *MORTALITY,
1485 BASELINE STUDIES, ALASKA/GULF OF, MONITORING, BENTHOS, DISTRIBUTION, *PRODUCTIVITY, STATISTICAL ANALYSIS, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS,
1486 BASELINE STUDIES, BIOLOGICAL EFFECTS, OFFSHORE PRODUCTION, OIL TRANSPORT, BENTHOS, OIL SPILLS, BERING SEA,
1487 BASELINE STUDIES, ALASKA/GULF OF, MARINE MAMMALS, BIOLOGICAL EFFECTS, OFFSHORE

DEVELOPMENT, DISTRIBUTION,
1488 BASELINE STUDIES, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS, OIL-GAS LEASING, OIL SPILLS, DISTRIBUTION, MARINE MAMMALS, BERING SEA, BEAUFORT SEA,
1489 BASELINE STUDIES, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS, MARINE MAMMALS, DISTRIBUTION, BERING SEA, *WHALES,
1490 BASELINE STUDIES, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS, OIL-GAS LEASING, MARINE MAMMALS, DISTRIBUTION, BERING SEA,
1491 BASELINE STUDIES, ALASKA, BENTHOS, SEDIMENTS, MONITORING, OCS, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT,
1492 BASELINE STUDIES, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, FISH, FISHERIES, HABITAT, BERING SEA, *PACIFIC HERRING,
1494 BASELINE STUDIES, MONITORING, PHYTOPLANKTON, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, *PRIMARY PRODUCTION,
1497 BASELINE STUDIES, ALASKA/GULF OF, MONITORING, FISH, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, BERING SEA, BEAUFORT SEA, *FISH DISEASES,
1498 BASELINE STUDIES, MONITORING, DISTRIBUTION, MARINE ORGANISMS, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS, BERING SEA,
1499 BASELINE STUDIES, ALASKA/GULF OF, FISHERIES, FISH, *SHELLFISH, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS, *DEMERSAL RESOURCES,
1501 BASELINE STUDIES, ALASKA, MARINE MAMMALS, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, DISTRIBUTION, *SEA OTTERS,
1503 BASELINE STUDIES, ALASKA/GULF OF, FISH, FOOD WEB, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, BERING SEA,
1505 BASELINE STUDIES, ALASKA/GULF OF, ACUTE EFFECTS, MONITORING, MARINE ORGANISMS, DISTRIBUTION, INTERTIDAL ZONE, COASTS, CHRONIC EFFECTS, BERING SEA,
1523 BASELINE STUDIES, ARCTIC, OFFSHORE DRILLING, SPILL CLEANUP, ICE, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, BEAUFORT SEA,
1533 BASELINE STUDIES, ALASKA, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, OCS, MARINE ORGANISMS, BIRDS,
1534 BASELINE STUDIES, ALASKA, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, OCS,
1545 BASELINE STUDIES, BIODEGRADATION, HYDROCARBONS, MICROORGANISMS, OFFSHORE DEVELOPMENT, OCS, BEAUFORT SEA,
1546 BASELINE STUDIES, ALASKA/GULF OF, BIODEGRADATION, HYDROCARBONS, MICROORGANISMS, OFFSHORE DEVELOPMENT, OCS,
1561 BASELINE STUDIES, BACTERIA, ALASKA/GULF OF, ACUTE EFFECTS, BIODEGRADATION, CRUDE OIL, UPTAKE, METABOLISM, BEAUFORT SEA,
1588 BASELINE STUDIES, ALASKA/GULF OF, OIL SPILLS, MOVEMENT, OFFSHORE DRILLING, *OCEAN CIRCULATION,
1590 BASELINE STUDIES, ALASKA, MODELS, *CIRCULATION, OCS, OIL SPILLS, FATE, *TRAJECTORY ANALYSIS,
1591 BASELINE STUDIES, ALASKA/GULF OF, OFFSHORE DEVELOPMENT, OIL SPILLS, FATE, OCS, *OCEAN CIRCULATION, *FLOW TRAJECTORIES,
1597 BASELINE STUDIES, ALASKA, *OCEAN CIRCULATION, OCS, FATE, CONTAMINANTS, OFFSHORE DEVELOPMENT,
1629 BASELINE STUDIES, ARCTIC, BIBLIOGRAPHIES, OIL SPILLS, MARINE ORGANISMS, BIOLOGICAL EFFECTS, SUBARCTIC REGIONS,
1632 BASELINE STUDIES, ALASKA/GULF OF, BIBLIOGRAPHIES, FISH, *NON-SALMONID PELAGIC FISHES, BERING SEA,
1108 BEACHES, OIL SPILLS, NORTH SEA, SCOTLAND,
1084 BEACHES, SAMPLING, HYDROCARBONS, REFINERIES, CONTAMINATION, SEDIMENTS,
1336 BEACHES, SPILL CLEANUP, OIL WELLS, POLLUTION CONTROL, DISPOSAL , RESTORATION, BEAUFORT SEA,
1556 BEACHES, BIODEGRADATION, CRUDE OIL, MICROORGANISMS, OXIDATION, *BEACH GRAVEL,
1031 BEAUFORT SEA, BASELINE STUDIES, MONITORING, *OCEAN CURRENTS, OCS, OFFSHORE DEVELOPMENT, FATE, CONTAMINANTS,
1061 BEAUFORT SEA, BASELINE STUDIES, ALASKA/GULF OF, MONITORING, *MARINE CLIMATOLOGY, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, BERING SEA,
1070 BEAUFORT SEA, MONITORING, TAR, SOURCES, DISTRIBUTION, COASTS,
1088 BEAUFORT SEA, SAMPLING, HYDROCARBONS, CHEMICAL ANALYSIS, SEAWATER, FISH, PLANKTON, SEDIMENTS, SOURCES,
1336 BEAUFORT SEA, BEACHES, SPILL CLEANUP, OIL WELLS, POLLUTION CONTROL, DISPOSAL , RESTORATION,
1337 BEAUFORT SEA, SPILL CLEANUP, POLLUTION CONTROL, DETECTION, MONITORING, DISPOSAL , *EQUIPMENT EVALUATION,
1348 BEAUFORT SEA, ALGAE, ICE, PHYTOPLANKTON, *PRIMARY PRODUCTIVITY, *OIL-UNDER-ICE,
1469 BEAUFORT SEA, BASELINE STUDIES, MONITORING, ESTUARIES, FISHERIES, DISTRIBUTION, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS,
1471 BEAUFORT SEA, BASELINE STUDIES, MONITORING, HABITAT, MARINE ORGANISMS, COASTS, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS,
1472 BEAUFORT SEA, MONITORING, MARINE MAMMALS, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, BERING SEA, *BEARDED AND RINGED SEALS, *ECOLOGY,
1474 BEAUFORT SEA, BASELINE STUDIES, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, MARINE MAMMALS, HABITAT, ICE, DISTRIBUTION, BERING SEA,
1476 BEAUFORT SEA, BIOLOGICAL EFFECTS, OFFSHORE DRILLING, OIL SPILLS, BENTHOS, FOOD WEB,
1477 BEAUFORT SEA, BASELINE STUDIES, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, BENTHOS,

DISTRIBUTION,
1479 BEAUFORT SEA, BASELINE STUDIES, ZOOPLANKTON, *MICRONEKTON, DISTRIBUTION, OFFSHORE DEVELOPMENT, BERING SEA,
1482 BEAUFORT SEA, BASELINE STUDIES, MONITORING, PLANKTON, DISTRIBUTION, BIBLIOGRAPHIES,
1488 BEAUFORT SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS, OIL-GAS LEASING, OIL SPILLS, DISTRIBUTION, MARINE MAMMALS, BERING SEA,
1495 BEAUFORT SEA, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, MARINE MAMMALS, OCS, DISTRIBUTION, BERING SEA, *SEALS, *TROPHIC STRUCTURE,
1497 BEAUFORT SEA, BASELINE STUDIES, ALASKA/GULF OF, MONITORING, FISH, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, BERING SEA, *FISH DISEASES,
1523 BEAUFORT SEA, BASELINE STUDIES, ARCTIC, OFFSHORE DRILLING, SPILL CLEANUP, ICE, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS,
1531 BEAUFORT SEA, OFFSHORE DRILLING, OIL SPILLS, SPREADING, MOVEMENT, ENVIRONMENTAL EFFECTS, MARINE MAMMALS, BIRDS, FISH,
1545 BEAUFORT SEA, BASELINE STUDIES, BIODEGRADATION, HYDROCARBONS, MICROORGANISMS, OFFSHORE DEVELOPMENT, OCS,
1553 BEAUFORT SEA, BIODEGRADATION, CRUDE OIL, MICROORGANISMS, SAMPLING, BIOLOGICAL EFFECTS,
1561 BEAUFORT SEA, BASELINE STUDIES, BACTERIA, ALASKA/GULF OF, ACUTE EFFECTS, BIODEGRADATION, CRUDE OIL, UPTAKE, METABOLISM,
1592 BEAUFORT SEA, OIL SLICKS, COASTS, MOVEMENT, *IMPACT LOCATIONS,
1630 BEAUFORT SEA, BIBLIOGRAPHIES, FISH, DISTRIBUTION, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS,
1340 BEHAVIOR, ARCTIC, SPILL CLEANUP, DISPOSAL , DETECTION, *ARCTIC MARINE OIL SPILL PROGRAM,
1372 BEHAVIOR, TOXICITY, CONTAMINANTS, MARINE ORGANISMS, *SUBLETHAL EFFECTS,
1390 BEHAVIOR, ACUTE EFFECTS, TOXICITY, FUEL OIL, ZOOPLANKTON, *WATER SOLUBLE FRACTIONS,
1410 BEHAVIOR, ARCTIC, CRUDE OIL, MARINE ORGANISMS, INVERTEBRATES, BIOLOGICAL EFFECTS, METABOLISM,
1569 BEHAVIOR, CRUDE OIL, SPREADING, COALESCENCE, EMUSIFICATION, ICE, RIVERS,
1573 BEHAVIOR, ARCTIC, ABSORPTION, OIL SPILLS, SPREADING, ICE, SOLUBILITY, CLEANUP,
1032 BENTHOS, MONITORING, MARINE ORGANISMS, DISTRIBUTION, SEDIMENTS, UK, *SUBLITTORAL MACROFAUNA, *MILFORD HAVEN,
1099 BENTHOS, HYDROCARBONS, CHEMICAL ANALYSIS, DISTRIBUTION, OCS, TEXAS, MEXICO/GULF OF,
1361 BENTHOS, PETROLEUM PRODUCTS, TOXICITY, MARINE ORGANISMS, FISH, BLACK SEA, *SHRIMP, *ELECTRICAL CURRENTS,
1409 BENTHOS, ARCTIC, CRUDE OIL, CRUSTACEANS, BIOLOGICAL EFFECTS, SEDIMENTS, *AMPHIPODS, *ISOPODS,
1461 BENTHOS, SEDIMENTATION, ENVIRONMENTAL EFFECTS, OIL SPILLS, *ANIMAL-SEDIMENT RELATIONSHIPS,
1476 BENTHOS, BEAUFORT SEA, BIOLOGICAL EFFECTS, OFFSHORE DRILLING, OIL SPILLS, FOOD WEB,
1477 BENTHOS, BEAUFORT SEA, BASELINE STUDIES, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, DISTRIBUTION,
1484 BENTHOS, ALASKA/GULF OF, DISTRIBUTION, *PRODUCTIVITY, BERING SEA, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS,
1485 BENTHOS, BASELINE STUDIES, ALASKA/GULF OF, MONITORING, DISTRIBUTION, *PRODUCTIVITY, STATISTICAL ANALYSIS, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS,
1486 BENTHOS, BASELINE STUDIES, BIOLOGICAL EFFECTS, OFFSHORE PRODUCTION, OIL TRANSPORT, OIL SPILLS, BERING SEA,
1491 BENTHOS, BASELINE STUDIES, ALASKA, SEDIMENTS, MONITORING, OCS, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT,
1493 BENTHOS, OFFSHORE DEVELOPMENT, PLANKTON, OCS, ECOSYSTEMS, ENVIRONMENTAL EFFECTS,
1040 BERING SEA, BASELINE STUDIES, MONITORING, HYDROCARBONS, DISTRIBUTION, OCS, OFFSHORE DEVELOPMENT, *NATURALLY-OCCURRING HYDROCARBONS,
1061 BERING SEA, BEAUFORT SEA, BASELINE STUDIES, ALASKA/GULF OF, MONITORING, *MARINE CLIMATOLOGY, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS,
1370 BERING SEA, ALASKA, ACUTE EFFECTS, HYDROCARBONS, TOXICITY, FISH, CHRONIC EFFECTS,
1467 BERING SEA, BASELINE STUDIES, MONITORING, PHYTOPLANKTON, ICE, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS, FOOD WEB,
1472 BERING SEA, BEAUFORT SEA, MONITORING, MARINE MAMMALS, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, *BEARDED AND RINGED SEALS, *ECOLOGY,
1473 BERING SEA, BASELINE STUDIES, MARINE MAMMALS, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, DISTRIBUTION, *SPOTTED SEAL,
1474 BERING SEA, BEAUFORT SEA, BASELINE STUDIES, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, MARINE MAMMALS, HABITAT, ICE, DISTRIBUTION,
1479 BERING SEA, BEAUFORT SEA, BASELINE STUDIES, ZOOPLANKTON, *MICRONEKTON, DISTRIBUTION, OFFSHORE DEVELOPMENT,
1483 BERING SEA, BASELINE STUDIES, MARINE MAMMALS, TOXICITY, OFFSHORE DEVELOPMENT, *MORTALITY,
1484 BERING SEA, BENTHOS, ALASKA/GULF OF, DISTRIBUTION, *PRODUCTIVITY, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS,
1486 BERING SEA, BENTHOS, BASELINE STUDIES, BIOLOGICAL EFFECTS, OFFSHORE PRODUCTION, OIL TRANSPORT, OIL SPILLS,
1488 BERING SEA, BEAUFORT SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS, OIL-GAS LEASING, OIL SPILLS, DISTRIBUTION, MARINE MAMMALS,
1489 BERING SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS, MARINE

MAMMALS, DISTRIBUTION, *WHALES,

1490 BERING SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS, OIL-GAS LEASING, MARINE MAMMALS, DISTRIBUTION,
1492 BERING SEA, BASELINE STUDIES, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, FISH, FISHERIES, HABITAT, *PACIFIC HERRING,
1495 BERING SEA, BEAUFORT SEA, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, MARINE MAMMALS, OCS, DISTRIBUTION, *SEALS, *TROPHIC STRUCTURE,
1497 BERING SEA, BEAUFORT SEA, BASELINE STUDIES, ALASKA/GULF OF, MONITORING, FISH, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, *FISH DISEASES,
1498 BERING SEA, BASELINE STUDIES, MONITORING, DISTRIBUTION, MARINE ORGANISMS, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS,
1503 BERING SEA, BASELINE STUDIES, ALASKA/GULF OF, FISH, FOOD WEB, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT,
1505 BERING SEA, BASELINE STUDIES, ALASKA/GULF OF, ACUTE EFFECTS, MONITORING, MARINE ORGANISMS, DISTRIBUTION, INTERTIDAL ZONE, COASTS, CHRONIC EFFECTS,
1593 BERING SEA, *CIRCULATION, OFFSHORE DEVELOPMENT, CONTAMINATION, FOOD WEB, FISHERIES, *BRISTOL BAY,
1632 BERING SEA, BASELINE STUDIES, ALASKA/GULF OF, BIBLIOGRAPHIES, FISH, *NON-SALMONID PELAGIC FISHES,
1482 BIBLIOGRAPHIES, BEAUFORT SEA, BASELINE STUDIES, MONITORING, PLANKTON, DISTRIBUTION,
1624 BIBLIOGRAPHIES, ARCTIC, OIL SLICKS, CONTAINMENT, RECOVERY, OIL TRANSFER, STORAGE, SPILL DISPOSAL, BIODEGRADATION, ICE,
1625 BIBLIOGRAPHIES, OIL INDUSTRY, CHEMICAL ANALYSIS, OIL SPILLS, SOURCE IDENTIFICATION, HYDROCARBONS, MARINE ORGANISMS,
1626 BIBLIOGRAPHIES, PIPELINES, OIL TRANSPORT, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS,
1627 BIBLIOGRAPHIES, BACTERIA, ALGAE, BIODEGRADATION, OIL SPILLS, HYDROCARBONS, SPILL CLEANUP,
1628 BIBLIOGRAPHIES, WILDLIFE, MARINE ORGANISMS, BIRDS, CONTAMINATION, *ENDANGERED SPECIES, *WATER POLLUTION,
1629 BIBLIOGRAPHIES, BASELINE STUDIES, ARCTIC, OIL SPILLS, MARINE ORGANISMS, BIOLOGICAL EFFECTS, SUBARCTIC REGIONS,
1630 BIBLIOGRAPHIES, BEAUFORT SEA, FISH, DISTRIBUTION, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS,
1631 BIBLIOGRAPHIES, ESTUARIES, COASTS, CONTAMINATION,
1632 BIBLIOGRAPHIES, BERING SEA, BASELINE STUDIES, ALASKA/GULF OF, FISH, *NON-SALMONID PELAGIC FISHES,
1633 BIBLIOGRAPHIES, OIL SPILLS, FATE, BIOLOGICAL EFFECTS, MARINE ORGANISMS, SPILL CLEANUP,
1036 BILGES, BALLAST, MONITORING, OIL DISCHARGES, SHIPS,
1049 BILGES, BALLAST, ANALYTICAL TECHNIQUES, MONITORING, SPECTROMETRY, DETECTION, WASTE OIL, *SUMMING LUMINESCENCE SPECTROMETRY,
1065 BILGES, MONITORING, FUEL OIL, DETECTION, SHIPS, DESIGN-ENGINEERING, *OIL-IN-WATER DETECTOR,
1232 BILGES, WASTE OIL TREATMENT, EMULSIONS, OIL TANKS, SPILL RECOVERY, *DEMULSIFYING AGENTS,
1264 BILGES, WASTEWATER TREATMENT, OIL-WATER SEPARATION, FILTRATION, *TUBULAR ULTRAFILTRATION SYSTEM,
1273 BILGES, SHIPS, WASTEWATER TREATMENT, EMULSIONS, OIL-WATER SEPARATION, *DEMULSIFICATION,
1300 BILGES, WASTEWATER TREATMENT, OIL-WATER SEPARATION, EMULSIONS, COALESCENCE, *PEAT,
1304 BILGES, WASTE OIL DISPOSAL, MONITORING, TANKERS, RHINE RIVER, *COMPUTER SURVEILLANCE,
1102 BIODEGRADATION, BACTERIA, HYDROCARBONS, SEDIMENTS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, PETROLEUM PRODUCTS, COASTS, FLORIDA,
1160 BIODEGRADATION, SPILL DISPOSAL, SOIL, MICROORGANISMS, PATENT,
1175 BIODEGRADATION, OIL SLICKS, SPILL CLEANUP, MICROORGANISMS, PATENT, *NUTRIENT PARTICLES,
1263 BIODEGRADATION, BACTERIA, OIL WELLS, DRILLING, WASTEWATER TREATMENT, FLOCCULATION, PATENT,
1392 BIODEGRADATION, BACTERIA, REFINERIES, WASTEWATERS, ENVIRONMENTAL EFFECTS, MARINE ORGANISMS, PHYTOPLANKTON, FRANCE,
1394 BIODEGRADATION, CRUDE OIL, WASTE OIL, SOIL, BIOLOGICAL EFFECTS, FUNGI,
1544 BIODEGRADATION, CRUDE OIL, MICROORGANISMS, MARSHES, ESTUARIES,
1545 BIODEGRADATION, BEAUFORT SEA, BASELINE STUDIES, HYDROCARBONS, MICROORGANISMS, OFFSHORE DEVELOPMENT, OCS,
1546 BIODEGRADATION, BASELINE STUDIES, ALASKA/GULF OF, HYDROCARBONS, MICROORGANISMS, OFFSHORE DEVELOPMENT, OCS,
1547 BIODEGRADATION, ARCTIC, CRUDE OIL, PETROLEUM PRODUCTS, TOXICITY, CRUSTACEANS, MONITORING, *AMPHIPODS,
1548 BIODEGRADATION, BACTERIA, HYDROCARBONS, *LYSIS, *IONIC CONCENTRATION,
1549 BIODEGRADATION, BACTERIA, HYDROCARBONS, OXIDATION, TOXICITY, SURFACTANTS, *IONIC CONCENTRATION, *DETERGENTS,
1550 BIODEGRADATION, BACTERIA, HYDROCARBONS, COASTS, MONITORING,
1551 BIODEGRADATION, BACTERIA, OIL SLICKS, SPILL CLEANUP, DESIGN-ENGINEERING, PATENT,
1552 BIODEGRADATION, HYDROCARBONS, MICROORGANISMS, *AQUATIC ENVIRONMENT,
1553 BIODEGRADATION, BEAUFORT SEA, CRUDE OIL, MICROORGANISMS, SAMPLING, BIOLOGICAL EFFECTS,
1554 BIODEGRADATION, ATLANTIC OCEAN, CRUDE OIL, HYDROCARBONS, MICROORGANISMS, SAMPLING,
1555 BIODEGRADATION, BACTERIA, HYDROCARBONS, NARRAGANSETT BAY, *GROWTH STUDIES,
1556 BIODEGRADATION, BEACHES, CRUDE OIL, MICROORGANISMS, OXIDATION, *BEACH GRAVEL,

1557 BIODEGRADATION, PETROLEUM PRODUCTS, FUELS, MICROORGANISMS,
1558 BIODEGRADATION, BACTERIA, HYDROCARBONS, METABOLISM,
1559 BIODEGRADATION, HYDROCARBONS, MICROORGANISMS, POLLUTION CONTROL,
1560 BIODEGRADATION, BACTERIA, COASTS, *COASTAL WATERS, SEDIMENTS, BLACK SEA, USSR,
1561 BIODEGRADATION, BEAUFORT SEA, BASELINE STUDIES, BACTERIA, ALASKA/GULF OF, ACUTE EFFECTS, CRUDE OIL, UPTAKE, METABOLISM,
1562 BIODEGRADATION, BACTERIA, OIL SPILLS, FATE, EMULSIFICATION, DISPERSIONS, WEATHERING,
1563 BIODEGRADATION, ATLANTIC COAST, CRUDE OIL, MICROORGANISMS, SAMPLING, OFFSHORE DRILLING, *OIL DEVELOPMENT SITES,
1564 BIODEGRADATION, BACTERIA, OIL SPILLS, PETROLEUM PRODUCTS,
1565 BIODEGRADATION, BACTERIA, HYDROCARBONS, METABOLISM, ESTUARIES, *CYCLOHEXANE,
1566 BIODEGRADATION, BACTERIA, ALASKA/GULF OF, OIL SLICKS, NEUSTON, BLACK SEA, CASPIAN SEA, *AZOV SEA,
1567 BIODEGRADATION, BACTERIA, AROMATIC HYDROCARBONS, MICROORGANISMS, SEDIMENTS, CHESAPEAKE BAY,
1568 BIODEGRADATION, BACTERIA, CRUDE OIL, MICROORGANISMS, ESTUARIES,
1589 BIODEGRADATION, CONTAMINATION, RIVERS, SEDIMENTS, *PARRAMATTA RIVER, *MUDS,
1624 BIODEGRADATION, BIBLIOGRAPHIES, ARCTIC, OIL SLICKS, CONTAINMENT, RECOVERY, OIL TRANSFER, STORAGE, SPILL DISPOSAL, ICE,
1627 BIODEGRADATION, BIBLIOGRAPHIES, BACTERIA, ALGAE, OIL SPILLS, HYDROCARBONS, SPILL CLEANUP,
1029 BIOLOGICAL EFFECTS, OIL SPILLS,
1082 BIOLOGICAL EFFECTS, ATLANTIC COAST, SAMPLING, MICROORGANISMS, DISTRIBUTION, SEAWATER, SEDIMENTS, OFFSHORE DRILLING,
1203 BIOLOGICAL EFFECTS, OIL TRANSPORT, OIL DISCHARGES, SOURCES, FATE, MARINE ORGANISMS, FISHERIES, PACIFIC OCEAN,
1350 BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA/GULF OF, OFFSHORE DEVELOPMENT, OIL SPILLS, *PRIMARY PRODUCTION, FOOD WEB,
1353 BIOLOGICAL EFFECTS, API, CRUDE OIL, MARINE ORGANISMS, PLATFORMS, NATURAL SEEPAGE, CHRONIC EFFECTS,
1356 BIOLOGICAL EFFECTS, ARCTIC, ALGAE, ALASKA, PLANTS, *LICHENS, CRUDE OIL,
1358 BIOLOGICAL EFFECTS, OIL SPILLS, MONITORING, WASTEWATERS, REFINERIES, PORTS, UK, *MILFORD HAVEN, *OIL POLLUTION RESEARCH UNIT,
1359 BIOLOGICAL EFFECTS, WASTEWATERS, REFINERIES, MARSHES, SHORELINES, VEGETATION, UK,
1360 BIOLOGICAL EFFECTS, ALGAE, METULA SPILL, BIRDS, MOLLUSKS, FISHERIES, MAGELLAN/STRAIT OF,
1363 BIOLOGICAL EFFECTS, FUEL OIL, MARINE ORGANISMS, TROPICAL REGIONS, INTERTIDAL ZONE, CORALS,
1365 BIOLOGICAL EFFECTS, OIL SPILLS, PLANTS, SAMPLING, MARSHES, *SPECIES REDUCTION,
1367 BIOLOGICAL EFFECTS, BACTERIA, AROMATIC HYDROCARBONS, TOXICITY,
1371 BIOLOGICAL EFFECTS, WASTEWATERS, REFINERIES, VEGETATION, MARSHES, UK, *SALTMARSH,
1374 BIOLOGICAL EFFECTS, HYDROCARBONS, *WATER SOLUBLE FRACTIONS,
1378 BIOLOGICAL EFFECTS, ALASKA, OIL SPILLS, MARINE MAMMALS, METABOLISM, *PHYSIOLOGY, *PINNIPEDS,
1380 BIOLOGICAL EFFECTS, CRUDE OIL, CORALS, *GROWTH, *GREAT BARRIER REEF,
1381 BIOLOGICAL EFFECTS, FUEL OIL, BIRDS, *YOLK STRUCTURE, *EGG HATCHABILITY,
1383 BIOLOGICAL EFFECTS, PETROLEUM PRODUCTS, MOLLUSKS, CALIFORNIA/SOUTHERN, *TOLERANCE VARIABILITY, *LITTORINA,
1387 BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA/GULF OF, OIL SPILLS, OCS, MOLLUSKS, HABITAT, OFFSHORE DEVELOPMENT, *CLAMS,
1388 BIOLOGICAL EFFECTS, CRUDE OIL, MOLLUSKS, *LARVAE, *OXYGEN UPTAKE , *MERETRIX LUSORIA,
1389 BIOLOGICAL EFFECTS, CRUDE OIL, PHYTOPLANKTON, MARSHES, *ENVIRONMENTAL STRESS, *DIATOMS,
1393 BIOLOGICAL EFFECTS, CRUDE OIL, DISPERSANTS, POLYCHAETES, UK, *ARENICOLA MARINA L, *MILFORD HAVEN,
1394 BIOLOGICAL EFFECTS, BIODEGRADATION, CRUDE OIL, WASTE OIL, SOIL, FUNGI,
1396 BIOLOGICAL EFFECTS, ALASKA, HYDROCARBONS, FISH, CRUSTACEANS, UPTAKE, RELEASE, *BIOTRANSFORMATION,
1400 BIOLOGICAL EFFECTS, API, CRUDE OIL, MARINE ORGANISMS, PLATFORMS, NATURAL SEEPAGE, CHRONIC EFFECTS,
1401 BIOLOGICAL EFFECTS, PETROLEUM PRODUCTS, CRUDE OIL, CONTAMINATION,
1402 BIOLOGICAL EFFECTS, OIL SPILLS, TANKERS, PORTS, MARINE ORGANISMS, MARSHES, METULA SPILL, UK, *MILFORD HAVEN,
1404 BIOLOGICAL EFFECTS, ALGAE, METABOLISM, UPTAKE, *PHOTOSYNTHESIS, *RESPIRATION,
1405 BIOLOGICAL EFFECTS, MARINE ORGANISMS, CONTAMINATION, *METABOLIC INTERACTIONS,
1406 BIOLOGICAL EFFECTS, CONTAMINATION, OCEANS, PETROLEUM PRODUCTS, FOOD WEB, PHYTOPLANKTON,
1407 BIOLOGICAL EFFECTS, OIL SPILLS, CHRONIC EFFECTS, MARINE ORGANISMS,
1408 BIOLOGICAL EFFECTS, HYDROCARBONS, PLANTS, FOOD WEB, *PHOTOSYNTHESIS, *ZOSTERA MARINA,
1409 BIOLOGICAL EFFECTS, BENTHOS, ARCTIC, CRUDE OIL, CRUSTACEANS, SEDIMENTS, *AMPHIPODS, *ISOPODS,
1410 BIOLOGICAL EFFECTS, BEHAVIOR, ARCTIC, CRUDE OIL, MARINE ORGANISMS, INVERTEBRATES, METABOLISM,
1412 BIOLOGICAL EFFECTS, PHYTOPLANKTON, *DINOFLAGELLATES, *DIATOMS,
1417 BIOLOGICAL EFFECTS, ANALYTICAL TECHNIQUES, HYDROCARBONS, MARINE ORGANISMS, *SPIN-LABELING TECHNIQUES,
1418 BIOLOGICAL EFFECTS, HYDROCARBONS, LAKES, PHYTOPLANKTON, *OUTBOARD MARINE ENGINE EXHAUST,

1422 BIOLOGICAL EFFECTS, FUEL OIL, MOLLUSKS, *CLAMS, *MYA ARENARIA,

1426 BIOLOGICAL EFFECTS, ALASKA, CRUDE OIL, MOLLUSKS, SEDIMENTS, *CLAMS, *INDICATOR SPECIES, *MACOMA BALTHICA,

1429 BIOLOGICAL EFFECTS, ALGAE, HYDROCARBONS, METABOLISM, *NAPHTHALENE,

1432 BIOLOGICAL EFFECTS, CONTAMINANTS, MARINE ORGANISMS, PETROLEUM PRODUCTS, *PHYSIOLOGICAL RESPONSE,

1435 BIOLOGICAL EFFECTS, CRUDE OIL, MOLLUSKS, *CLAMS,

1436 BIOLOGICAL EFFECTS, CRUDE OIL, MOLLUSKS, *CLAMS,

1444 BIOLOGICAL EFFECTS, ATLANTIC OCEAN, ARGO MERCHANT SPILL, FATE, MARINE ORGANISMS,

1449 BIOLOGICAL EFFECTS, OIL DISCHARGES, SHIPS, TANKERS, CONTAMINATION, FATE, DISPERSANTS,

1459 BIOLOGICAL EFFECTS, CONTAMINANTS, FATE, ENVIRONMENTAL EFFECTS, REGULATIONS, *BOOK REVIEW,

1465 BIOLOGICAL EFFECTS, ANIMALS, OIL SLICKS, PHYSICAL EFFECTS, PLANTS, *OXYGEN EXCHANGE, *TEMPERATURE, *LIGHT REDUCTION, *ROCK POOLS,

1467 BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, MONITORING, PHYTOPLANKTON, ICE, OFFSHORE DEVELOPMENT, FOOD WEB,

1469 BIOLOGICAL EFFECTS, BEAUFORT SEA, BASELINE STUDIES, MONITORING, ESTUARIES, FISHERIES, DISTRIBUTION, OFFSHORE DEVELOPMENT,

1471 BIOLOGICAL EFFECTS, BEAUFORT SEA, BASELINE STUDIES, MONITORING, HABITAT, MARINE ORGANISMS, COASTS, OFFSHORE DEVELOPMENT,

1472 BIOLOGICAL EFFECTS, BERING SEA, BEAUFORT SEA, MONITORING, MARINE MAMMALS, OFFSHORE DEVELOPMENT, *BEARDED AND RINGED SEALS, *ECOLOGY,

1473 BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, MARINE MAMMALS, OFFSHORE DEVELOPMENT, DISTRIBUTION, *SPOTTED SEAL,

1474 BIOLOGICAL EFFECTS, BERING SEA, BEAUFORT SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT, MARINE MAMMALS, HABITAT, ICE, DISTRIBUTION,

1475 BIOLOGICAL EFFECTS, ALASKA/GULF OF, OFFSHORE DEVELOPMENT, MARINE MAMMALS, DISTRIBUTION, *SEA LIONS, *ECOLOGY, *TROPHIC STRUCTURE,

1476 BIOLOGICAL EFFECTS, BENTHOS, BEAUFORT SEA, OFFSHORE DRILLING, OIL SPILLS, FOOD WEB,

1477 BIOLOGICAL EFFECTS, BENTHOS, BEAUFORT SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT, DISTRIBUTION,

1478 BIOLOGICAL EFFECTS, ATLANTIC OCEAN, OFFSHORE PRODUCTION, EIS, OCS, *GEORGES BANK,

1480 BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA/GULF OF, ZOOPLANKTON, MONITORING, DISTRIBUTION, OFFSHORE DEVELOPMENT,

1481 BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA/GULF OF, MONITORING, DISTRIBUTION, PLANKTON, *ICHTHYOPLANKTON, OFFSHORE DEVELOPMENT,

1484 BIOLOGICAL EFFEATS, BERING SEA, BENTHOS, ALASKA/GULF OF, DISTRIBUTION, *PRODUCTIVITY, OFFSHORE DEVELOPMENT,

1485 BIOLOGICAL EFFECTS, BENTHOS, BASELINE STUDIES, ALASKA/GULF OF, MONITORING, DISTRIBUTION, *PRODUCTIVITY, STATISTICAL ANALYSIS, OFFSHORE DEVELOPMENT,

1486 BIOLOGICAL EFFECTS, BERING SEA, BENTHOS, BASELINE STUDIES, OFFSHORE PRODUCTION, OIL TRANSPORT, OIL SPILLS,

1487 BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA/GULF OF, MARINE MAMMALS, OFFSHORE DEVELOPMENT, DISTRIBUTION,

1488 BIOLOGICAL EFFECTS, BERING SEA, BEAUFORT SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT, OIL-GAS LEASING, OIL SPILLS, DISTRIBUTION, MARINE MAMMALS,

1489 BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT, MARINE MAMMALS, DISTRIBUTION, *WHALES,

1490 BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT, OIL-GAS LEASING, MARINE MAMMALS, DISTRIBUTION,

1492 BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT, OCS, FISH, FISHERIES, HABITAT, *PACIFIC HERRING,

1494 BIOLOGICAL EFFECTS, BASELINE STUDIES, MONITORING, PHYTOPLANKTON, OFFSHORE DEVELOPMENT, *PRIMARY PRODUCTION,

1495 BIOLOGICAL EFFECTS, BERING SEA, BEAUFORT SEA, OFFSHORE DEVELOPMENT, MARINE MAMMALS, OCS, DISTRIBUTION, *SEALS, *TROPHIC STRUCTURE,

1498 BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, MONITORING, DISTRIBUTION, MARINE ORGANISMS, OFFSHORE DEVELOPMENT,

1499 BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA/GULF OF, FISHERIES, FISH, *SHELLFISH, OFFSHORE DEVELOPMENT, *DEMERSAL RESOURCES,

1500 BIOLOGICAL EFFECTS, ALASKA/GULF OF, OFFSHORE DEVELOPMENT, MARINE MAMMALS, CONTAMINANTS, FOOD WEB, *ECOLOGY, *HARBOR SEAL,

1501 BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA, MARINE MAMMALS, OFFSHORE DEVELOPMENT, DISTRIBUTION, *SEA OTTERS,

1503 BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, ALASKA/GULF OF, FISH, FOOD WEB, OFFSHORE DEVELOPMENT,

1542 BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, HABITAT, ONSHORE IMPACTS, SPILL CLEANUP, POLLUTION PREVENTION,

1553 BIOLOGICAL EFFECTS, BIODEGRADATION, BEAUFORT SEA, CRUDE OIL, MICROORGANISMS, SAMPLING,

1579 BIOLOGICAL EFFECTS, ATLANTIC OCEAN, ARGO MERCHANT SPILL, FUEL OIL, FATE, MARINE ORGANISMS, CONTAMINATION, NOAA,

1584 BIOLOGICAL EFFECTS, OIL SPILLS, FATE, DISTRIBUTION, HYDROCARBONS, MARSHES, METABOLISM, MARINE ORGANISMS, MASSACHUSETTS,

1595 BIOLOGICAL EFFECTS, ACUTE EFFECTS, OIL DISCHARGES, FATE, CHRONIC EFFECTS, MARINE

ORGANISMS, NORTH SEA,
1629 BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, BASELINE STUDIES, ARCTIC, OIL SPILLS, MARINE ORGANISMS, SUBARCTIC REGIONS,
1630 BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, BEAUFORT SEA, FISH, DISTRIBUTION, OFFSHORE DEVELOPMENT,
1633 BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, OIL SPILLS, FATE, MARINE ORGANISMS, SPILL CLEANUP,
1012 BIRDS, CONTAMINATION, MONITORING, UK, *BIRD MORTALITY,
1015 BIRDS, OIL SLICKS, COASTS, CONTAMINATION, RESTORATION, ENGLAND,
1197 BIRDS, RESTORATION, OIL SPILLS, SOLVENTS,
1198 BIRDS, RESTORATION, OIL SPILLS, CONTAMINATION, TORREY CANYON, OLYMPIC GAMES SPILL,
1199 BIRDS, RESTORATION, OLYMPIC GAMES SPILL, PERSONNEL TRAINING,
1360 BIRDS, BIOLOGICAL EFFECTS, ALGAE, METULA SPILL, MOLLUSKS, FISHERIES, MAGELLAN/STRAIT OF,
1379 BIRDS, BALTIC SEA, CONTAMINATION, STATISTICS, *MORTALITY,
1381 BIRDS, BIOLOGICAL EFFECTS, FUEL OIL, *YOLK STRUCTURE, *EGG HATCHABILITY,
1384 BIRDS, ACUTE EFFECTS, CRUDE OIL, CONTAMINATION, WILDLIFE, CHRONIC EFFECTS,
1425 BIRDS, BALTIC SEA, CRUDE OIL, CONTAMINATION, STATISTICS, *MORTALITY, *GDANSK BAY,
1470 BIRDS, ALASKA, OIL FIELDS, DEVELOPMENT, COASTS, ENVIRONMENTAL PROTECTION, PRUDHOE BAY, *TUNDRA WETLANDS,
1531 BIRDS, BEAUFORT SEA, OFFSHORE DRILLING, OIL SPILLS, SPREADING, MOVEMENT, ENVIRONMENTAL EFFECTS, MARINE MAMMALS, FISH,
1533 BIRDS, BASELINE STUDIES, ALASKA, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, OCS, MARINE ORGANISMS,
1628 BIRDS, BIBLIOGRAPHIES, WILDLIFE, MARINE ORGANISMS, CONTAMINATION, *ENDANGERED SPECIES, *WATER POLLUTION,
1361 BLACK SEA, BENTHOS, PETROLEUM PRODUCTS, TOXICITY, MARINE ORGANISMS, FISH, *SHRIMP, *ELECTRICAL CURRENTS,
1560 BLACK SEA, BIODEGRADATION, BACTERIA, COASTS, *COASTAL WATERS, SEDIMENTS, USSR,
1566 BLACK SEA, BIODEGRADATION, BACTERIA, ALASKA/GULF OF, OIL SLICKS, NEUSTON, CASPIAN SEA, *AZOV SEA,
1518 BLM, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, HYDROCARBONS, *TRACE METALS,
1524 BLM, ATLANTIC OCEAN, ARGO MERCHANT SPILL, OIL-GAS LEASING, EIS, ENVIRONMENTAL EFFECTS, FISHERIES, *GEORGES BANK,
1328 BLOWOUT PREVENTION, OFFSHORE DRILLING, *RISERLESS DRILLING METHOD,
1132 BOOMS, SPILL CONTAINMENT, DESIGN-ENGINEERING, PATENT,
1133 BOOMS, SPILL CONTAINMENT, DESIGN-ENGINEERING, PATENT,
1135 BOOMS, SPILL CONTAINMENT, TANKERS, DESIGN-ENGINEERING,
1136 BOOMS, SPILL CONTAINMENT, DESIGN-ENGINEERING, PATENT, *FENDING DEVICE,
1138 BOOMS, ABSORPTION, SPILL CONTAINMENT, DESIGN-ENGINEERING, HYDROCARBONS, PATENT,
1139 BOOMS, ADSORPTION, SPILL CONTAINMENT, HYDROCARBONS, DESIGN-ENGINEERING, PATENT,
1140 BOOMS, SPILL CLEANUP, SKIMMERS, OIL SLICKS, DESIGN-ENGINEERING, PATENT,
1149 BOOMS, SPILL CLEANUP, SKIMMERS, *VIKOMA INTERNATIONAL,
1172 BOOMS, SPILL CONTAINMENT, SPILL CLEANUP, MODELS, SKIMMERS, *HYDRODYNAMIC PROBLEMS,
1194 BOOMS, SPILL CONTAINMENT, SPILL RECOVERY, RIVERS, ICE, CANADA, *ST. CLAIR & DETROIT RIVERS,
1196 BOOMS, SPILL CLEANUP, SKIMMERS, DESIGN-ENGINEERING, PATENT,
1344 BOOMS, SPILL CLEANUP, POLLUTION CONTROL, SKIMMERS,
1510 CALIFORNIA, OCS, OIL-GAS LEASING, OFFSHORE DEVELOPMENT, ONSHORE IMPACTS, POLLUTION CONTROL,
1571 CALIFORNIA, GROUNDWATER, CONTAMINATION, WASTEWATER DISPOSAL, SPREADING,
1602 CALIFORNIA, LEGISLATION, OIL SPILLS, LIABILITY, TANKERS, OIL TRANSPORT,
1514 CALIFORNIA COAST, OIL-GAS LEASING, OCS, ENVIRONMENTAL EFFECTS, EIS, OFFSHORE DEVELOPMENT,
1519 CALIFORNIA COAST, OFFSHORE DEVELOPMENT, ONSHORE IMPACTS, LEGISLATION,
1536 CALIFORNIA COAST, OFFSHORE DRILLING, ONSHORE IMPACTS, POLLUTION PREVENTION, *LAND USE CONFLICTS,
1383 CALIFORNIA/SOUTHERN, BIOLOGICAL EFFECTS, PETROLEUM PRODUCTS, MOLLUSKS, *TOLERANCE VARIABILITY, *LITTORINA,
1142 CANADA, ARCTIC, OIL WELLS, *BLOWOUTS, SPILL DISPOSAL, INCINERATION, ICE,
1173 CANADA, SPILL CLEANUP, COASTS, ENVIRONMENTAL EFFECTS, RESTORATION,
1194 CANADA, BOOMS, SPILL CONTAINMENT, SPILL RECOVERY, RIVERS, ICE, *ST. CLAIR & DETROIT RIVERS,
1294 CANADA, TAR SANDS, DEVELOPMENT, WASTEWATER DISPOSAL, WATER QUALITY,
1345 CANADA, POLLUTION CONTROL, SPILL RECOVERY, SKIMMERS, *EQUIPMENT TESTING,
1385 CANADA, BACTERIA, TOXICITY, CRUDE OIL, FUEL OIL, COASTS, *GLUCOSE UPTAKE,
1586 CANADA, OIL SLICKS, MOVEMENT, MODELS,
1621 CANADA, POLLUTION CONTROL, REFINERIES, WASTEWATERS, REGULATIONS, GUIDELINES, MONITORING,
1089 CARCINOGENS, PAH, MODELS, *BENZO(A)ANTHRACENE,
1098 CARCINOGENS, PAH, CRUDE OIL, CHEMICAL ANALYSIS, CHROMATOGRAPHY, SPECTROMETRY,
1107 CARCINOGENS, AROMATIC HYDROCARBONS, CHEMICAL ANALYSIS, CONTAMINANTS, *ORGANIC POLLUTANTS,
1087 CARIBBEAN SEA, ATLANTIC OCEAN, SAMPLING, TAR,
1566 CASPIAN SEA, BLACK SEA, BIODEGRADATION, BACTERIA, ALASKA/GULF OF, OIL SLICKS, NEUSTON, *AZOV SEA,

1056 CHEMICAL ANALYSIS, MONITORING, CRUDE OIL, FISH, CHROMATOGRAPHY, *EELS, *BIO-INDICATORS,
1067 CHEMICAL ANALYSIS, AROMATIC HYDROCARBONS, MONITORING, WASTEWATERS, REFINERIES, *COLORIMETRY,
1088 CHEMICAL ANALYSIS, BEAUFORT SEA, SAMPLING, HYDROCARBONS, SEAWATER, FISH, PLANKTON, SEDIMENTS, SOURCES,
1091 CHEMICAL ANALYSIS, SEDIMENTS, OFFSHORE PRODUCTION,
1092 CHEMICAL ANALYSIS, HYDROCARBONS, SAMPLING, REFINERIES, PETROCHEMICALS, SOURCES, MEXICO/GULF OF, *MISSISSIPPI DELTA,
1093 CHEMICAL ANALYSIS, OIL SLICKS, HYDROCARBONS, SWEDEN,
1095 CHEMICAL ANALYSIS, HYDROCARBONS, EXTRACTION, SOLVENTS, CHROMATOGRAPHY, SPECTROMETRY,
1097 CHEMICAL ANALYSIS, WASTEWATERS, DETECTION, *OIL TRACES, *ADSORPTION POLAROGRAPHY,
1098 CHEMICAL ANALYSIS, CARCINOGENS, PAH, CRUDE OIL, CHROMATOGRAPHY, SPECTROMETRY,
1099 CHEMICAL ANALYSIS, BENTHOS, HYDROCARBONS, DISTRIBUTION, OCS, TEXAS, MEXICO/GULF OF,
1100 CHEMICAL ANALYSIS, HYDROCARBONS, MOLLUSKS, MARINE ORGANISMS, CHROMATOGRAPHY, *SOXHLET EXTRACTION, *SAPONIFICATION,
1102 CHEMICAL ANALYSIS, BIODEGRADATION, BACTERIA, HYDROCARBONS, SEDIMENTS, CHROMATOGRAPHY, PETROLEUM PRODUCTS, COASTS, FLORIDA,
1103 CHEMICAL ANALYSIS, CRUDE OIL, CHROMATOGRAPHY, WEATHERING,
1104 CHEMICAL ANALYSIS, HYDROCARBONS, CHROMATOGRAPHY, WASTEWATERS, *GASOLINE FRACTIONS,
1106 CHEMICAL ANALYSIS, ACTIVATED SLUDGE, HYDROCARBONS, DECOMPOSITION, CHROMATOGRAPHY,
1107 CHEMICAL ANALYSIS, CARCINOGENS, AROMATIC HYDROCARBONS, CONTAMINANTS, *ORGANIC POLLUTANTS,
1108 CHEMICAL ANALYSIS, SEDIMENTS, PORTS, OCEANS, PETROLEUM PRODUCTS, CONTAMINATION, USSR,
1109 CHEMICAL ANALYSIS, PAH, CHROMATOGRAPHY, EXTRACTION, *FLUORESCENCE,
1110 CHEMICAL ANALYSIS, HYDROCARBONS, CHROMATOGRAPHY, DESIGN-ENGINEERING, *HYDROCARBON MEASUREMENTS,
1118 CHEMICAL ANALYSIS, WASTEWATERS, DETECTION, HYDROCARBONS, CRANKCASE OIL, MARINE ORGANISMS, NEW YORK,
1119 CHEMICAL ANALYSIS, API, CRUDE OIL, SOURCE IDENTIFICATION,
1123 CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, CRUDE OIL, HYDROCARBONS, CHROMATOGRAPHY,
1124 CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, OIL SPILLS, SPECTROSCOPY, SEAWATER,
1126 CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, PAH, SOURCES, CHROMATOGRAPHY, SPECTROMETRY, SEDIMENTS, *AQUATIC ENVIRONMENT,
1127 CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, CRUDE OIL, *FLUOROMETRY,
1129 CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, *TAR BALLS, CHROMATOGRAPHY, SAMPLING, CRUDE OIL, WEATHERING, ISRAEL, MEDITERRANEAN SEA,
1286 CHEMICAL ANALYSIS, WASTEWATER TREATMENT, HYDROCARBONS, OXIDATION, TOXICITY, *AERATION,
1290 CHEMICAL ANALYSIS, WASTEWATER TREATMENT, DISPOSAL, REFINERIES, CONTAMINANTS,
1441 CHEMICAL ANALYSIS, PETROLEUM PRODUCTS, CONTAMINATION, GROUNDWATER, OIL TANKS, USSR,
1625 CHEMICAL ANALYSIS, BIBLIOGRAPHIES, OIL INDUSTRY, OIL SPILLS, SOURCE IDENTIFICATION, HYDROCARBONS, MARINE ORGANISMS,
1445 CHESAPEAKE BAY, SHIPS, PORTS, POLLUTION CONTROL, OIL SPILLS, *SYMPOSIUM,
1567 CHESAPEAKE BAY, BIODEGRADATION, BACTERIA, AROMATIC HYDROCARBONS, MICROORGANISMS, SEDIMENTS,
1462 CHINA, OIL SPILLS, ENVIRONMENTAL EFFECTS, FISHERIES, PLANKTON, MONITORING, *HONG KONG,
1056 CHROMATOGRAPHY, CHEMICAL ANALYSIS, MONITORING, CRUDE OIL, FISH, *EELS, *BIO-INDICATORS,
1094 CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, HYDROCARBONS, MARINE ORGANISMS, SEDIMENTS, SPECTROSCOPY, PUGET SOUND, WASHINGTON,
1095 CHROMATOGRAPHY, CHEMICAL ANALYSIS, HYDROCARBONS, EXTRACTION, SOLVENTS, SPECTROMETRY,
1098 CHROMATOGRAPHY, CHEMICAL ANALYSIS, CARCINOGENS, PAH, CRUDE OIL, SPECTROMETRY,
1100 CHROMATOGRAPHY, CHEMICAL ANALYSIS, HYDROCARBONS, MOLLUSKS, MARINE ORGANISMS, *SOXHLET EXTRACTION, *SAPONIFICATION,
1102 CHROMATOGRAPHY, CHEMICAL ANALYSIS, BIODEGRADATION, BACTERIA, HYDROCARBONS, SEDIMENTS, PETROLEUM PRODUCTS, COASTS, FLORIDA,
1103 CHROMATOGRAPHY, CHEMICAL ANALYSIS, CRUDE OIL, WEATHERING,
1104 CHROMATOGRAPHY, CHEMICAL ANALYSIS, HYDROCARBONS, WASTEWATERS, *GASOLINE FRACTIONS,
1106 CHROMATOGRAPHY, CHEMICAL ANALYSIS, ACTIVATED SLUDGE, HYDROCARBONS, DECOMPOSITION,
1109 CHROMATOGRAPHY, CHEMICAL ANALYSIS, PAH, EXTRACTION, *FLUORESCENCE,
1110 CHROMATOGRAPHY, CHEMICAL ANALYSIS, HYDROCARBONS, DESIGN-ENGINEERING, *HYDROCARBON MEASUREMENTS,
1117 CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, PAH, LAKES, SEDIMENTS, SPECTROMETRY,
1121 CHROMATOGRAPHY, AROMATIC HYDROCARBONS, ANALYTICAL TECHNIQUES, SPECTROSCOPY, SEDIMENTS, LAKES, *FLUORESCENCE,
1123 CHROMATOGRAPHY, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, CRUDE OIL, HYDROCARBONS,
1126 CHROMATOGRAPHY, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, PAH, SOURCES, SPECTROMETRY, SEDIMENTS, *AQUATIC ENVIRONMENT,
1129 CHROMATOGRAPHY, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, *TAR BALLS, SAMPLING, CRUDE OIL, WEATHERING, ISRAEL, MEDITERRANEAN SEA,
1130 CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, OIL SPILLS, CRUDE OIL, SPECTROSCOPY, SPECTROMETRY, *US BUREAU OF MINES,
1352 CHRONIC EFFECTS, NATURAL SEEPAGE, MARINE ORGANISMS, HYDROCARBONS, SANTA BARBARA CHANNEL,
1353 CHRONIC EFFECTS, BIOLOGICAL EFFECTS, API, CRUDE OIL, MARINE ORGANISMS, PLATFORMS, NATURAL SEEPAGE,
1368 CHRONIC EFFECTS, ALASKA, ACUTE EFFECTS, CRUDE OIL, TOXICITY, CRUSTACEANS, *CANCER

MAGISTER DANA, *WATER SOLUBLE FRACTION,
1370 CHRONIC EFFECTS, BERING SEA, ALASKA, ACUTE EFFECTS, HYDROCARBONS, TOXICITY, FISH,
1384 CHRONIC EFFECTS, BIRDS, ACUTE EFFECTS, CRUDE OIL, CONTAMINATION, WILDLIFE,
1400 CHRONIC EFFECTS, BIOLOGICAL EFFECTS, API, CRUDE OIL, MARINE ORGANISMS, PLATFORMS, NATURAL SEEPAGE,
1407 CHRONIC EFFECTS, BIOLOGICAL EFFECTS, OIL SPILLS, MARINE ORGANISMS,
1414 CHRONIC EFFECTS, ALASKA, ACUTE EFFECTS, CRUDE OIL, TOXICITY, MARINE ORGANISMS, METABOLISM,
1424 CHRONIC EFFECTS, ACUTE EFFECTS, FUEL OIL, OIL SPILLS, TOXICITY, MOLLUSKS, INTERTIDAL ZONE, *HONG KONG,
1428 CHRONIC EFFECTS, CONTAMINATION, FISHERIES, JAPAN, *TOKYO BAY, *SETO INLAND SEA,
1505 CHRONIC EFFECTS, BERING SEA, BASELINE STUDIES, ALASKA/GULF OF, ACUTE EFFECTS, MONITORING, MARINE ORGANISMS, DISTRIBUTION, INTERTIDAL ZONE, COASTS,
1595 CHRONIC EFFECTS, BIOLOGICAL EFFECTS, ACUTE EFFECTS, OIL DISCHARGES, FATE, MARINE ORGANISMS, NORTH SEA,
1243 COALESCENCE, WASTEWATER TREATMENT, PETROLEUM PRODUCTS, FILTRATION, DESIGN-ENGINEERING, PATENT,
1245 COALESCENCE, WASTEWATER TREATMENT, OIL-WATER SEPARATION, EMULSIONS,
1246 COALESCENCE, OIL-WATER SEPARATION, EMULSIONS, DESIGN-ENGINEERING,
1248 COALESCENCE, OIL-WATER SEPARATION, DISPERSIONS, PATENT, *BROMINATED POLYETHYLENE GRANULES,
1251 COALESCENCE, WASTEWATER TREATMENT, REFINERIES, OIL-WATER SEPARATION, FLOCCULATION, FLOTATION, *OZONATION,
1257 COALESCENCE, OIL-WATER SEPARATION, EMULSIONS, DESIGN-ENGINEERING, PATENT, *METAL CATALYSTS,
1269 COALESCENCE, EMULSIONS, OIL-WATER SEPARATION, FILTRATION, PATENT,
1274 COALESCENCE, OIL-WATER SEPARATION, DESIGN-ENGINEERING,
1275 COALESCENCE, OIL-WATER SEPARATION, HYDROCARBONS, DISPERSIONS, PATENT,
1281 COALESCENCE, OIL-WATER SEPARATION, EMULSIONS, FLOTATION, FILTRATION, PATENT, *MAGNETIC POWDER,
1292 COALESCENCE, OIL-WATER SEPARATION, EMULSIONS, *FIBROUS BED COALESCERS,
1300 COALESCENCE, BILGES, WASTEWATER TREATMENT, OIL-WATER SEPARATION, EMULSIONS, *PEAT,
1569 COALESCENCE, BEHAVIOR, CRUDE OIL, SPREADING, EMUSIFICATION, ICE, RIVERS,
1015 COASTS, BIRDS, OIL SLICKS, CONTAMINATION, RESTORATION, ENGLAND,
1034 COASTS, BASELINE STUDIES, MONITORING, CONTAMINANTS, HYDROCARBONS, MEDITERRANEAN SEA, *POLLUTANT TRANSPORT,
1037 COASTS, MONITORING, CONTAMINANTS, ESTUARIES, *METHODS, *INDICATOR ORGANISMS,
1038 COASTS, BASELINE STUDIES, ALASKA, MONITORING, *STREAMFLOW, ESTUARIES, OFFSHORE DEVELOPMENT, OIL SPILLS, ENVIRONMENTAL EFFECTS,
1059 COASTS, BASELINE STUDIES, ALASKA, MONITORING, *WIND CONDITIONS, OFFSHORE DEVELOPMENT, FATE, CONTAMINANTS,
1070 COASTS, BEAUFORT SEA, MONITORING, TAR, SOURCES, DISTRIBUTION,
1080 COASTS, REMOTE SENSING, OIL SPILLS, DETECTION, MODELS, POLLUTION PREVENTION, *LINEAR PROGRAMMING,
1102 COASTS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, BIODEGRADATION, BACTERIA, HYDROCARBONS, SEDIMENTS, PETROLEUM PRODUCTS, FLORIDA,
1116 COASTS, ANALYTICAL TECHNIQUES, CONTAMINANTS, HYDROCARBONS, GERMANY, EAST, *SPECTROPHOTOMETRY, *COLORIMETRY,
1173 COASTS, CANADA, SPILL CLEANUP, ENVIRONMENTAL EFFECTS, RESTORATION,
1385 COASTS, CANADA, BACTERIA, TOXICITY, CRUDE OIL, FUEL OIL, *GLUCOSE UPTAKE,
1421 COASTS, WASTEWATERS, INDUSTRIES, HYDROCARBONS, MARINE ORGANISMS, ECOSYSTEMS,
1464 COASTS, BASELINE STUDIES, OIL SPILLS, ENVIRONMENTAL EFFECTS, *COASTAL IMPACTS,
1470 COASTS, BIRDS, ALASKA, OIL FIELDS, DEVELOPMENT, ENVIRONMENTAL PROTECTION, PRUDHOE BAY, *TUNDRA WETLANDS,
1471 COASTS, BIOLOGICAL EFFECTS, BEAUFORT SEA, BASELINE STUDIES, MONITORING, HABITAT, MARINE ORGANISMS, OFFSHORE DEVELOPMENT,
1505 COASTS, CHRONIC EFFECTS, BERING SEA, BASELINE STUDIES, ALASKA/GULF OF, ACUTE EFFECTS, MONITORING, MARINE ORGANISMS, DISTRIBUTION, INTERTIDAL ZONE,
1517 COASTS, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, RESOURCE MANAGEMENT, *CONFERENCES, *COASTAL IMPACTS,
1526 COASTS, OFFSHORE PRODUCTION, EXTRACTION, FATE, HYDROCARBONS, ENVIRONMENTAL EFFECTS, *PRODUCED WATERS,
1535 COASTS, OFFSHORE DEVELOPMENT, ONSHORE IMPACTS, PORTS, SOCIO-ECONOMIC EFFECTS, NEW JERSEY, DELAWARE,
1550 COASTS, BIODEGRADATION, BACTERIA, HYDROCARBONS, MONITORING,
1560 COASTS, BLACK SEA, BIODEGRADATION, BACTERIA, *COASTAL WATERS, SEDIMENTS, USSR,
1574 COASTS, ARCTIC OCEAN, ALASKA, OIL SPILLS, ICE, *OIL-ICE INTERACTION,
1592 COASTS, BEAUFORT SEA, OIL SLICKS, MOVEMENT, *IMPACT LOCATIONS,
1615 COASTS, INTERNATIONAL CONVENTIONS, HARBORS, POLLUTION PREVENTION, SHIPS, LIABILITY, COMPENSATION, IMCO,
1631 COASTS, BIBLIOGRAPHIES, ESTUARIES, CONTAMINATION,
1527 COLORADO, OIL SHALE, EXTRACTION, EIS, SOLID WASTES, DISPOSAL, RESTORATION,
1327 COMPENSATION, OIL SPILLS, LIABILITY, POLLUTION PREVENTION, SPILL CLEANUP, *CONGRESSIONAL BILL,
1601 COMPENSATION, REGULATIONS, LEGISLATION, SPILL CLEANUP, STATE GOVERNMENTS, OIL

TRANSFER, NEW JERSEY,
1604 COMPENSATION, LEGISLATION, US, LIABILITY, SPILL CLEANUP,
1608 COMPENSATION, LEGISLATION, OIL DISCHARGES, LIABILITY, US, STATE GOVERNMENTS, *NAVIGABLE WATERS,
1615 COMPENSATION, COASTS, INTERNATIONAL CONVENTIONS, HARBORS, POLLUTION PREVENTION, SHIPS, LIABILITY, IMCO,
1316 CONSERVATION, WASTE OIL, RECLAMATION, ECONOMIC EFFECTS, ENVIRONMENTAL EFFECTS, UK,
1031 CONTAMINANTS, BEAUFORT SEA, BASELINE STUDIES, MONITORING, *OCEAN CURRENTS, OCS, OFFSHORE DEVELOPMENT, FATE,
1034 CONTAMINANTS, COASTS, BASELINE STUDIES, MONITORING, HYDROCARBONS, MEDITERRANEAN SEA, *POLLUTANT TRANSPORT,
1037 CONTAMINANTS, COASTS, MONITORING, ESTUARIES, *METHODS, *INDICATOR ORGANISMS,
1046 CONTAMINANTS, MONITORING, MOLLUSKS, CRUSTACEANS, COST ANALYSIS, *MUSSELS, *BARNACLES,
1053 CONTAMINANTS, MONITORING, DETECTION, *OIL-IN-WATER, PATENT,
1059 CONTAMINANTS, COASTS, BASELINE STUDIES, ALASKA, MONITORING, *WIND CONDITIONS, OFFSHORE DEVELOPMENT, FATE,
1060 CONTAMINANTS, BASELINE STUDIES, ALASKA/GULF OF, MONITORING, *OCEAN CURRENTS, FATE, OFFSHORE DEVELOPMENT,
1066 CONTAMINANTS, MONITORING, POLLUTION PREVENTION, *UN,
1068 CONTAMINANTS, MONITORING, CRUDE OIL, FUEL OIL, DETECTION, DESIGN-ENGINEERING, PATENT, *OPTICAL SENSOR,
1073 CONTAMINANTS, BALTIC SEA, REMOTE SENSING, *WIND EFFECTS, *WAVE EFFECTS,
1101 CONTAMINANTS, AROMATIC HYDROCARBONS, ANALYTICAL TECHNIQUES, HYDROCARBONS, *WATER POLLUTANTS,
1107 CONTAMINANTS, CHEMICAL ANALYSIS, CARCINOGENS, AROMATIC HYDROCARBONS, *ORGANIC POLLUTANTS,
1111 CONTAMINANTS, ANALYTICAL TECHNIQUES, SPECTROMETRY, *POLLUTANT CLASSIFICATION, *COMPUTER-SPECTROMETER SYSTEM,
1116 CONTAMINANTS, COASTS, ANALYTICAL TECHNIQUES, HYDROCARBONS, GERMANY, EAST, *SPECTROPHOTOMETRY, *COLORIMETRY,
1166 CONTAMINANTS, SPILL RECOVERY, SKIMMERS, DESIGN-ENGINEERING, PATENT,
1242 CONTAMINANTS, WASTEWATER TREATMENT, DISPOSAL, PETROLEUM PRODUCTS,
1249 CONTAMINANTS, ABSORPTION, WASTEWATER TREATMENT, INDUSTRIES, *PEAT MOSS,
1290 CONTAMINANTS, CHEMICAL ANALYSIS, WASTEWATER TREATMENT, DISPOSAL, REFINERIES,
1372 CONTAMINANTS, BEHAVIOR, TOXICITY, MARINE ORGANISMS, *SUBLETHAL EFFECTS,
1375 CONTAMINANTS, FUEL OIL, HYDROCARBONS, TOXICITY, *FUEL ADDITIVES,
1432 CONTAMINANTS, BIOLOGICAL EFFECTS, MARINE ORGANISMS, PETROLEUM PRODUCTS, *PHYSIOLOGICAL RESPONSE,
1452 CONTAMINANTS, BALTIC SEA, ECOSYSTEMS, HYDROCARBONS, ENVIRONMENTAL EFFECTS,
1459 CONTAMINANTS, BIOLOGICAL EFFECTS, FATE, ENVIRONMENTAL EFFECTS, REGULATIONS, *BOOK REVIEW,
1500 CONTAMINANTS, BIOLOGICAL EFFECTS, ALASKA/GULF OF, OFFSHORE DEVELOPMENT, MARINE MAMMALS, FOOD WEB, *ECOLOGY, *HARBOR SEAL,
1585 CONTAMINANTS, MODELS, FATE, MOVEMENT, OFFSHORE DRILLING, PRUDHOE BAY, *OCEAN CIRCULATION, *POLLUTANT TRANSPORT,
1597 CONTAMINANTS, BASELINE STUDIES, ALASKA, *OCEAN CIRCULATION, OCS, FATE, OFFSHORE DEVELOPMENT,
1012 CONTAMINATION, BIRDS, MONITORING, UK, *BIRD MORTALITY,
1015 CONTAMINATION, COASTS, BIRDS, OIL SLICKS, RESTORATION, ENGLAND,
1016 CONTAMINATION, SOURCES, HYDROCARBONS, WASTEWATERS, ITALY, *GULF OF TRIESTE,
1018 CONTAMINATION, SPILL CLEANUP, OIL TRANSFER, OIL SPILLS, PORTS, SHORELINES, ISRAEL, *EILAT OIL TERMINAL,
1024 CONTAMINATION, OIL SPILLS, FUEL OIL, FISHERIES, MASSACHUSETTS, *BUZZARDS BAY, *SHELLFISH RESOURCES,
1028 CONTAMINATION, WASTEWATERS, REFINERIES, INDUSTRIES, SOURCES, ECONOMIC EFFECTS, INFORMATION SYSTEMS,
1041 CONTAMINATION, MONITORING, GROUNDWATER, SPILL CLEANUP, DESIGN-ENGINEERING,
1052 CONTAMINATION, MONITORING, METABOLISM, MOLLUSKS, ESTUARIES, HYDROCARBONS, *ADENYLATE ENERGY CHARGE, *ENVIRONMENTAL STRESS,
1084 CONTAMINATION, BEACHES, SAMPLING, HYDROCARBONS, REFINERIES, SEDIMENTS,
1108 CONTAMINATION, CHEMICAL ANALYSIS, SEDIMENTS, PORTS, OCEANS, PETROLEUM PRODUCTS, USSR,
1181 CONTAMINATION, SOIL, *OIL REMOVAL, *DETERGENTS,
1198 CONTAMINATION, BIRDS, RESTORATION, OIL SPILLS, TORREY CANYON, OLYMPIC GAMES SPILL,
1279 CONTAMINATION, WASTE OIL, PETROLEUM PRODUCTS, PETROCHEMICALS, REFINING, RIVERS, USSR,
1379 CONTAMINATION, BIRDS, BALTIC SEA, STATISTICS, *MORTALITY,
1384 CONTAMINATION, CHRONIC EFFECTS, BIRDS, ACUTE EFFECTS, CRUDE OIL, WILDLIFE,
1401 CONTAMINATION, BIOLOGICAL EFFECTS, PETROLEUM PRODUCTS, CRUDE OIL,
1405 CONTAMINATION, BIOLOGICAL EFFECTS, MARINE ORGANISMS, *METABOLIC INTERACTIONS,
1406 CONTAMINATION, BIOLOGICAL EFFECTS, OCEANS, PETROLEUM PRODUCTS, FOOD WEB, PHYTOPLANKTON,
1425 CONTAMINATION, BIRDS, BALTIC SEA, CRUDE OIL, STATISTICS, *MORTALITY, *GDANSK BAY,
1428 CONTAMINATION, CHRONIC EFFECTS, FISHERIES, JAPAN, *TOKYO BAY, *SETO INLAND SEA,
1431 CONTAMINATION, FISH, *TEMPERATURE EFFECTS, *STURGEONS,
1441 CONTAMINATION, CHEMICAL ANALYSIS, PETROLEUM PRODUCTS, GROUNDWATER, OIL TANKS, USSR,
1442 CONTAMINATION, OIL INDUSTRY, HYDROCARBONS, DISPERSANTS, *AQUATIC POLLUTION,
1446 CONTAMINATION, OCEANS, ENVIRONMENTAL EFFECTS, WATER QUALITY, OFFSHORE EXPLORATION,

1449 CONTAMINATION, BIOLOGICAL EFFECTS, OIL DISCHARGES, SHIPS, TANKERS, FATE, DISPERSANTS,
1457 CONTAMINATION, OIL SPILLS, REFINERIES, DISPERSANTS, TOXICITY, MONITORING, *BOOK REVIEW,
1460 CONTAMINATION, RIVERS, WASTE OIL, TANKERS, OIL TRANSFER, IRAQ, *SHATT AL-ARAB,
1463 CONTAMINATION, CRUDE OIL, PETROLEUM PRODUCTS,
1466 CONTAMINATION, WATER QUALITY, FLORIDA COAST, *HUMAN IMPACT, *BISCAYNE BAY,
1502 CONTAMINATION, ALASKA, MARINE MAMMALS, DISTRIBUTION, HABITAT, OFFSHORE DEVELOPMENT, *SEA OTTERS,
1508 CONTAMINATION, OFFSHORE DEVELOPMENT, ECONOMIC EFFECTS, FISHERIES, FRANCE,
1571 CONTAMINATION, CALIFORNIA, GROUNDWATER, WASTEWATER DISPOSAL, SPREADING,
1579 CONTAMINATION, BIOLOGICAL EFFECTS, ATLANTIC OCEAN, ARGO MERCHANT SPILL, FUEL OIL, FATE, MARINE ORGANISMS, NOAA,
1581 CONTAMINATION, ATLANTIC OCEAN, ARGO MERCHANT SPILL, FUEL OIL, FATE, MARINE ORGANISMS, FISHERIES, MODELS, MOVEMENT, NOAA,
1589 CONTAMINATION, BIODEGRADATION, RIVERS, SEDIMENTS, *PARRAMATTA RIVER, *MUDS,
1593 CONTAMINATION, BERING SEA, *CIRCULATION, OFFSHORE DEVELOPMENT, FOOD WEB, FISHERIES, *BRISTOL BAY,
1628 CONTAMINATION, BIRDS, BIBLIOGRAPHIES, WILDLIFE, MARINE ORGANISMS, *ENDANGERED SPECIES, *WATER POLLUTION,
1631 CONTAMINATION, COASTS, BIBLIOGRAPHIES, ESTUARIES,
1072 CONTINGENCY PLANNING, ALASKA, REMOTE SENSING, OCS, OFFSHORE DEVELOPMENT, FATE, OIL SPILLS, ENVIRONMENTAL EFFECTS,
1226 CONTINGENCY PLANNING, ARGO MERCHANT SPILL, TANKERS, SAFETY, LIABILITY, USCG, MEXICO/GULF OF, *FLAGS OF CONVENIENCE,
1322 CONTINGENCY PLANNING, OIL SPILLS, POLLUTION PREVENTION, LIABILITY, *LEGAL RESPONSIBILITIES,
1324 CONTINGENCY PLANNING, OIL DISCHARGES, LEGISLATION, US, SPILL CLEANUP, SURVEILLANCE, DESIGN-ENGINEERING,
1331 CONTINGENCY PLANNING, POLLUTION PREVENTION, OIL DISCHARGES, REGULATIONS, EPA, DRILLING, *NAVIGABLE WATERS,
1363 CORALS, BIOLOGICAL EFFECTS, FUEL OIL, MARINE ORGANISMS, TROPICAL REGIONS, INTERTIDAL ZONE,
1369 CORALS, ACUTE EFFECTS, CRUDE OIL, TOXICITY, RED SEA, *HETEROXENIA FUSCESCENS,
1380 CORALS, BIOLOGICAL EFFECTS, CRUDE OIL, *GROWTH, *GREAT BARRIER REEF,
1046 COST ANALYSIS, CONTAMINANTS, MONITORING, MOLLUSKS, CRUSTACEANS, *MUSSELS, *BARNACLES,
1205 COST ANALYSIS, POLLUTION CONTROL, TANKERS, SEGREGATED BALLAST, REGULATIONS, USCG, ENVIRONMENTAL PROTECTION,
1222 COST ANALYSIS, OIL TRANSFER, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, SOCIO-ECONOMIC EFFECTS, MODELS, SPREADING,
1271 COST ANALYSIS, WASTE OIL DISPOSAL, SPILL DISPOSAL, STORAGE, USCG,
1276 COST ANALYSIS, SLUDGE, SOLID WASTES, DISPOSAL, INCINERATION, DESIGN-ENGINEERING,
1580 COST ANALYSIS, MODELS, OIL SPILLS, ENVIRONMENTAL EFFECTS, NORTH SEA, *COMPUTER SIMULATION,
1610 COST ANALYSIS, LEGISLATION, US, PORTS, TANKERS, OIL TRANSPORT, LIABILITY, *DEEPWATER PORT ACT,
1118 CRANKCASE OIL, CHEMICAL ANALYSIS, WASTEWATERS, DETECTION, HYDROCARBONS, MARINE ORGANISMS, NEW YORK,
1056 CRUDE OIL, CHROMATOGRAPHY, CHEMICAL ANALYSIS, MONITORING, FISH, *EELS, *BIO-INDICATORS,
1063 CRUDE OIL, ALASKA, MONITORING, SEDIMENTS, UPTAKE, RELEASE, INTERTIDAL ZONE, *PORT VALDEZ,
1068 CRUDE OIL, CONTAMINANTS, MONITORING, FUEL OIL, DETECTION, DESIGN-ENGINEERING, PATENT, *OPTICAL SENSOR,
1098 CRUDE OIL, CHROMATOGRAPHY, CHEMICAL ANALYSIS, CARCINOGENS, PAH, SPECTROMETRY,
1103 CRUDE OIL, CHROMATOGRAPHY, CHEMICAL ANALYSIS, WEATHERING,
1119 CRUDE OIL, CHEMICAL ANALYSIS, API, SOURCE IDENTIFICATION,
1123 CRUDE OIL, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, HYDROCARBONS,
1125 CRUDE OIL, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, *LUMINESCENCE CONTOUR SPECTRA,
1127 CRUDE OIL, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, *FLUOROMETRY,
1129 CRUDE OIL, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, SAMPLING, *TAR BALLS, WEATHERING, ISRAEL, MEDITERRANEAN SEA,
1130 CRUDE OIL, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, OIL SPILLS, SPECTROSCOPY, SPECTROMETRY, *US BUREAU OF MINES,
1131 CRUDE OIL, SOURCE IDENTIFICATION, PAH, HYDROCARBONS, SEDIMENTS, SOIL, PETROLEUM PRODUCTS,
1185 CRUDE OIL, ABSORPTION, SPILL RECOVERY, DESIGN-ENGINEERING, *SORBENTS,
1188 CRUDE OIL, ARCTIC, SPILL RECOVERY, SKIMMERS, FRESHWATER, ICE, *LOCKHEED CLEAN SWEEP,
1208 CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, EIS, *SALT DOMES, *TANK FARMS, *STRATEGIC PETROLEUM RESERVE,
1209 CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, EIS, LOUISIANA, *BAYOU CHOCTAW SALT DOME,
1210 CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, EIS, OIL TRANSPORT, WATER QUALITY, *BRYAN MOUND SALT DOMES,
1211 CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, EIS, WATER QUALITY, OIL SPILLS, KENTUCKY, *CENTRAL ROCK MINE,
1212 CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, EIS, WATER QUALITY, OIL SPILLS, LOUISIANA, *COTE BLANCHE MINE,
1213 CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, EIS, WATER QUALITY, OIL SPILLS, OHIO,

*IRONTON MINE,
1214 CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, EIS, WATER CUALITY, OIL SPILLS, TEXAS,
*KLEER MINE,
1215 CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, EIS, WATER QUALITY, OIL SPILLS, LOUISIANA,
*WEEKS ISLAND MINE,
1216 CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, EIS, OIL TRANSPORT, WATER QUALITY, *WEST
HACKBERRY SALT DOME,
1217 CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, FEA, *STRATEGIC PETROLEUM
RESERVE,
1225 CRUDE OIL, ALASKA, SPILL DISPOSAL, STORAGE, FUEL OIL,
1325 CRUDE OIL, POLLUTION PREVENTION, SPILL CLEANUP, FRANCE, *POLMAR PLAN,
1329 CRUDE OIL, FATE, ENVIRONMENTAL EFFECTS, POLLUTION PREVENTION, OFFSHORE DRILLING, OIL
TRANSPORT, SPILL CLEANUP, NORTH SEA,
1351 CRUDE OIL, DISPERSIONS, FUEL OIL, TOXICITY, MOLLUSKS, *OYSTER, *CRASSOSTREA, VIRGINICA,
1353 CRUDE OIL, CHRONIC EFFECTS, BIOLOGICAL EFFECTS, API, MARINE ORGANISMS, PLATFORMS,
NATURAL SEEPAGE,
1356 CRUDE OIL, BIOLOGICAL EFFECTS, ARCTIC, ALGAE, ALASKA, PLANTS, *LICHENS,
1366 CRUDE OIL, TOXICITY, MOLLUSKS, FUEL OIL, WASTE OIL, *CLAMS, *MERCENARIA,
1368 CRUDE OIL, CHRONIC EFFECTS, ALASKA, ACUTE EFFECTS, TOXICITY, CRUSTACEANS, *CANCER
MAGISTER DANA, *WATER SOLUBLE FRACTION,
1369 CRUDE OIL, CORALS, ACUTE EFFECTS, TOXICITY, RED SEA, *HETEROXENIA FUSCESCENS,
1380 CRUDE OIL, CORALS, BIOLOGICAL EFFECTS, *GROWTH, *GREAT BARRIER REEF,
1382 CRUDE OIL, BACTERIA, *REFINED OIL, TOXICITY, METABOLISM, MARINE ORGANISMS, WEATHERING,
1384 CRUDE OIL, CONTAMINATION, CHRONIC EFFECTS, BIRDS, ACUTE EFFECTS, WILDLIFE,
1385 CRUDE OIL, COASTS, CANADA, BACTERIA, TOXICITY, FUEL OIL, *GLUCOSE UPTAKE,
1388 CRUDE OIL, BIOLOGICAL EFFECTS, MOLLUSKS, *LARVAE, *OXYGEN UPTAKE , *MERETRIX LUSORIA,
1389 CRUDE OIL, BIOLOGICAL EFFECTS, PHYTOPLANKTON, MARSHES, *ENVIRONMENTAL STRESS, *DIATOMS,
1391 CRUDE OIL, TOXICITY, FUEL OIL, CRUSTACEANS, *AMPHIPODS,
1393 CRUDE OIL, BIOLOGICAL EFFECTS, DISPERSANTS, POLYCHAETES, UK, *ARENICOLA MARINA L,
*MILFORD HAVEN,
1394 CRUDE OIL, BIOLOGICAL EFFECTS, BIODEGRADATION, WASTE OIL, SOIL, FUNGI,
1395 CRUDE OIL, ALASKA, TOXICITY, FISH, *LIVER AND SKIN TISSUES,
1400 CRUDE OIL, CHRONIC EFFECTS, BIOLOGICAL EFFECTS, API, MARINE ORGANISMS, PLATFORMS,
NATURAL SEEPAGE,
1401 CRUDE OIL, CONTAMINATION, BIOLOGICAL EFFECTS, PETROLEUM PRODUCTS,
1403 CRUDE OIL, TOXICITY, FUEL OIL, MARINE ORGANISMS, ECHINODERMS, *SAND DOLLARS,
1409 CRUDE OIL, BIOLOGICAL EFFECTS, BENTHOS, ARCTIC, CRUSTACEANS, SEDIMENTS, *AMPHIPODS,
*ISOPODS,
1410 CRUDE OIL, BIOLOGICAL EFFECTS, BEHAVIOR, ARCTIC, MARINE ORGANISMS, INVERTEBRATES,
METABOLISM,
1411 CRUDE OIL, ARCTIC, TOXICITY, INVERTEBRATES, *AMPHIPOD, *COELENTERATE,
1414 CRUDE OIL, CHRONIC EFFECTS, ALASKA, ACUTE EFFECTS, TOXICITY, MARINE ORGANISMS,
METABOLISM,
1415 CRUDE OIL, ALASKA, FUEL OIL, HYDROCARBONS, FISH, *RESPIRATION RATE, *ONCORHYNCHUS
GORBUSCHA,
1419 CRUDE OIL, ALASKA/GULF OF, ACUTE EFFECTS, TOXICITY, FISH, FISHERIES, OFFSHORE
DEVELOPMENT, *PACIFIC HERRING,
1420 CRUDE OIL, ACUTE EFFECTS, TOXICITY, MARINE MAMMALS, *RINGED SEALS,
1423 CRUDE OIL, TOXICITY, FUEL OIL, MOLLUSKS, METABOLISM, *CLAMS, *MYA ARENARIA,
1425 CRUDE OIL, CONTAMINATION, BIRDS, BALTIC SEA, STATISTICS, *MORTALITY, *GDANSK BAY,
1426 CRUDE OIL, BIOLOGICAL EFFECTS, ALASKA, MOLLUSKS, SEDIMENTS, *CLAMS, *INDICATOR
SPECIES, *MACOMA BALTHICA,
1430 CRUDE OIL, TOXICITY, FUEL OIL, EMULSIONS, DISPERSANTS, MOLLUSKS, UK,
1435 CRUDE OIL, BIOLOGICAL EFFECTS, MOLLUSKS, *CLAMS,
1436 CRUDE OIL, BIOLOGICAL EFFECTS, MOLLUSKS, *CLAMS,
1448 CRUDE OIL, SEDIMENTS, OFFSHORE DEVELOPMENT, RELEASE, MICROORGANISMS, ENVIRONMENTAL
EFFECTS, *TRACE METALS,
1454 CRUDE OIL, METULA SPILL, ENVIRONMENTAL EFFECTS, MAGELLAN/STRAIT OF,
1463 CRUDE OIL, CONTAMINATION, PETROLEUM PRODUCTS,
1544 CRUDE OIL, BIODEGRADATION, MICROORGANISMS, MARSHES, ESTUARIES,
1547 CRUDE OIL, BIODEGRADATION, ARCTIC, PETROLEUM PRODUCTS, TOXICITY, CRUSTACEANS,
MONITORING, *AMPHIPODS,
1553 CRUDE OIL, BIOLOGICAL EFFECTS, BIODEGRADATION, BEAUFORT SEA, MICROORGANISMS, SAMPLING,
1554 CRUDE OIL, BIODEGRADATION, ATLANTIC OCEAN, HYDROCARBONS, MICROORGANISMS, SAMPLING,
1556 CRUDE OIL, BIODEGRADATION, BEACHES, MICROORGANISMS, OXIDATION, *BEACH GRAVEL,
1561 CRUDE OIL, BIODEGRADATION, BEAUFORT SEA, BASELINE STUDIES, BACTERIA, ALASKA/GULF OF,
ACUTE EFFECTS, UPTAKE, METABOLISM,
1563 CRUDE OIL, BIODEGRADATION, ATLANTIC COAST, MICROORGANISMS, SAMPLING, OFFSHORE
DRILLING, *OIL DEVELOPMENT SITES,
1568 CRUDE OIL, BIODEGRADATION, BACTERIA, MICROORGANISMS, ESTUARIES,
1569 CRUDE OIL, COALESCENCE, BEHAVIOR, SPREADING, EMUSIFICATION, ICE, RIVERS,
1572 CRUDE OIL, OIL SPILLS, MODELS, EVAPORATION, SOLUTION, HYDROCARBONS, TOXICITY,
1575 CRUDE OIL, MOVEMENT, ICE,
1594 CRUDE OIL, ARCTIC, ICE, MONITORING, SPREADING, MOVEMENT, WEATHERING, SPILL CLEANUP,
1620 CRUDE OIL, PETROLEUM PRODUCTS, OIL TRANSFER, TANKERS, SAFETY, GUIDELINES, *TERMINALS,

1046 CRUSTACEANS, COST ANALYSIS, CONTAMINANTS, MONITORING, MOLLUSKS, *MUSSELS, *BARNACLES,
1051 CRUSTACEANS, MONITORING, HYDROCARBONS, SEAWATER, *MOTOR BEHAVIOR,
1368 CRUSTACEANS, CRUDE OIL, CHRONIC EFFECTS, ALASKA, ACUTE EFFECTS, TOXICITY, *CANCER MAGISTER DANA, *WATER SOLUBLE FRACTION,
1377 CRUSTACEANS, HYDROCARBONS, UPTAKE, RELEASE, METABOLISM, FISH, *LABELED N-ALKANES,
1391 CRUSTACEANS, CRUDE OIL, TOXICITY, FUEL OIL, *AMPHIPODS,
1396 CRUSTACEANS, BIOLOGICAL EFFECTS, ALASKA, HYDROCARBONS, FISH, UPTAKE, RELEASE, *BIOTRANSFORMATION,
1409 CRUSTACEANS, CRUDE OIL, BIOLOGICAL EFFECTS, BENTHOS, ARCTIC, SEDIMENTS, *AMPHIPODS, *ISOPODS,
1547 CRUSTACEANS, CRUDE OIL, BIODEGRADATION, ARCTIC, PETROLEUM PRODUCTS, TOXICITY, MONITORING, *AMPHIPODS,
1106 DECOMPOSITION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, ACTIVATED SLUDGE, HYDROCARBONS,
1577 DECOMPOSITION, OIL SLICKS, HYDROCARBONS, *PHOTOCHEMICAL DEGRADATION,
1535 DELAWARE, COASTS, OFFSHORE DEVELOPMENT, ONSHORE IMPACTS, PORTS, SOCIO-ECONOMIC EFFECTS, NEW JERSEY,
1041 DESIGN-ENGINEERING, CONTAMINATION, MONITORING, GROUNDWATER, SPILL CLEANUP,
1042 DESIGN-ENGINEERING, BALLAST, MONITORING, OIL SLICKS, TANKERS, PATENT,
1045 DESIGN-ENGINEERING, MONITORING, OIL SLICKS, *SPILL TRACKING BUOY,
1050 DESIGN-ENGINEERING, MONITORING, OFFSHORE DRILLING, PATENT, *OIL-IN-WATER,
1065 DESIGN-ENGINEERING, BILGES, MONITORING, FUEL OIL, DETECTION, SHIPS, *OIL-IN-WATER DETECTOR,
1068 DESIGN-ENGINEERING, CRUDE OIL, CONTAMINANTS, MONITORING, FUEL OIL, DETECTION, PATENT, *OPTICAL SENSOR,
1069 DESIGN-ENGINEERING, MONITORING, OIL SLICKS, PATENT, *LIGHT SENSOR,
1074 DESIGN-ENGINEERING, REMOTE SENSING, OIL SLICKS, SURVEILLANCE,
1075 DESIGN-ENGINEERING, REMOTE SENSING, OIL SLICKS, DETECTION, OCEANS,
1081 DESIGN-ENGINEERING, SAMPLING, OIL SLICKS, SURFACTANTS, PATENT,
1110 DESIGN-ENGINEERING, CHROMATOGRAPHY, CHEMICAL ANALYSIS, HYDROCARBONS, *HYDROCARBON MEASUREMENTS,
1120 DESIGN-ENGINEERING, HYDROCARBONS, DISPERSIONS, *PETROLEUM BIOASSAY, *CONTINUOUS FLOW SYSTEM,
1132 DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT, PATENT,
1133 DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT, PATENT,
1135 DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT, TANKERS,
1136 DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT, PATENT, *FENDING DEVICE,
1138 DESIGN-ENGINEERING, BOOMS, ABSORPTION, SPILL CONTAINMENT, HYDROCARBONS, PATENT,
1139 DESIGN-ENGINEERING, BOOMS, ADSORPTION, SPILL CONTAINMENT, HYDROCARBONS, PATENT,
1140 DESIGN-ENGINEERING, BOOMS, SPILL CLEANUP, SKIMMERS, OIL SLICKS, PATENT,
1141 DESIGN-ENGINEERING, ABSORPTION, SPILL RECOVERY, *FERROMAGNETIC FOAM,
1144 DESIGN-ENGINEERING, SPILL RECOVERY,
1148 DESIGN-ENGINEERING, SPILL RECOVERY, WASTE OIL, FUELS, OIL-WATER SEPARATION, SKIMMERS,
1151 DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS, *DYNAMIC INCLINED PLANE SKIMMER,
1152 DESIGN-ENGINEERING, SOUTH AFRICA, *SALVAGE TUG, POLLUTION CONTROL, SPILL CLEANUP,
1153 DESIGN-ENGINEERING, SOUTH AFRICA, *SALVAGE TUG, POLLUTION CONTROL, SPILL CLEANUP,
1154 DESIGN-ENGINEERING, ABSORPTION, SKIMMERS, SPILL RECOVERY,
1155 DESIGN-ENGINEERING, SPILL RECOVERY, PATENT, *UNDERWATER FISSURES,
1156 DESIGN-ENGINEERING, SPILL RECOVERY, PATENT,
1158 DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS, PATENT,
1165 DESIGN-ENGINEERING, ABSORPTION, SPILL RECOVERY, PATENT, *SORBENT BROADCASTER,
1166 DESIGN-ENGINEERING, CONTAMINANTS, SPILL RECOVERY, SKIMMERS, PATENT,
1167 DESIGN-ENGINEERING, SPILL RECOVERY, SKIMMERS, PATENT,
1169 DESIGN-ENGINEERING, SPILL RECOVERY, SKIMMERS, *OELA-III SKIMMER,
1170 DESIGN-ENGINEERING, SPILL RECOVERY, PATENT,
1178 DESIGN-ENGINEERING, SPILL RECOVERY, OIL-WATER SEPARATION,
1179 DESIGN-ENGINEERING, SPILL RECOVERY, PATENT, *OIL MOP RIGGING SYSTEM,
1180 DESIGN-ENGINEERING, SPILL RECOVERY, PATENT, *GUIDED JET,
1184 DESIGN-ENGINEERING, SKIMMERS, SHIPS, PATENT, *WAVE DAMPING DEVICE,
1185 DESIGN-ENGINEERING, CRUDE OIL, ABSORPTION, SPILL RECOVERY, *SORBENTS,
1186 DESIGN-ENGINEERING, SPILL RECOVERY, OIL-WATER SEPARATION, PATENT,
1189 DESIGN-ENGINEERING, SPILL RECOVERY, SKIMMERS, *SLURP WEIR SKIMMER,
1195 DESIGN-ENGINEERING, SPILL RECOVERY, PATENT, *FLEXIBLE FLOATING PIPE,
1196 DESIGN-ENGINEERING, BOOMS, SPILL CLEANUP, SKIMMERS, PATENT,
1204 DESIGN-ENGINEERING, ARCTIC, OIL TRANSFER, SHIPS, *PUMPS, *ADAPTS,
1230 DESIGN-ENGINEERING, WASTEWATER TREATMENT, OIL-WATER SEPARATION,
1231 DESIGN-ENGINEERING, OIL-WATER SEPARATION,
1233 DESIGN-ENGINEERING, WASTEWATER TREATMENT, OIL-WATER SEPARATION, SHIPS, REFINERIES,
1235 DESIGN-ENGINEERING, OIL-WATER SEPARATION, WASTEWATERS, INLAND, SKIMMERS, *AFL INDUSTRIES,
1240 DESIGN-ENGINEERING, SLUDGE, REFINERIES, INCINERATION, DISPOSAL, *FLUID BED INCINERATION,
1243 DESIGN-ENGINEERING, COALESCENCE, WASTEWATER TREATMENT, PETROLEUM PRODUCTS, FILTRATION, PATENT,
1246 DESIGN-ENGINEERING, COALESCENCE, OIL-WATER SEPARATION, EMULSIONS,
1253 DESIGN-ENGINEERING, OIL-WATER SEPARATION, FLOTATION, *AERATION, *WEMCO HYDROCLEANER,

1256 DESIGN-ENGINEERING, OIL-WATER SEPARATION, FILTRATION, PATENT,
1257 DESIGN-ENGINEERING, COALESCENCE, OIL-WATER SEPARATION, EMULSIONS, PATENT, *METAL CATALYSTS,
1266 DESIGN-ENGINEERING, EMULSIONS, WASTEWATER TREATMENT, FILTRATION, PH CONTROL, PATENT,
1274 DESIGN-ENGINEERING, COALESCENCE, OIL-WATER SEPARATION,
1276 DESIGN-ENGINEERING, COST ANALYSIS, SLUDGE, SOLID WASTES, DISPOSAL, INCINERATION,
1278 DESIGN-ENGINEERING, OIL-WATER SEPARATION, PATENT,
1308 DESIGN-ENGINEERING, RECLAMATION, WASTE OIL, INDUSTRIES,
1318 DESIGN-ENGINEERING, WASTEWATER TREATMENT, RECYCLING, OIL-WATER SEPARATION,
1324 DESIGN-ENGINEERING, CONTINGENCY PLANNING, OIL DISCHARGES, LEGISLATION, US, SPILL CLEANUP, SURVEILLANCE,
1347 DESIGN-ENGINEERING, OFFSHORE DEVELOPMENT, OIL SPILLS, REGULATIONS, SAFETY, INFORMATION SYSTEMS, *OCEAN TECHNOLOGY,
1551 DESIGN-ENGINEERING, BIODEGRADATION, BACTERIA, OIL SLICKS, SPILL CLEANUP, PATENT,
1044 DETECTION, MONITORING, LEAKAGE, PIPELINES, PATENT, *MOBILE RECEIVER,
1049 DETECTION, BILGES, BALLAST, ANALYTICAL TECHNIQUES, MONITORING, SPECTROMETRY, WASTE OIL, *SUMMING LUMINESCENCE SPECTROMETRY,
1053 DETECTION, CONTAMINANTS, MONITORING, *OIL-IN-WATER, PATENT,
1065 DETECTION, DESIGN-ENGINEERING, BILGES, MONITORING, FUEL OIL, SHIPS, *OIL-IN-WATER DETECTOR,
1068 DETECTION, DESIGN-ENGINEERING, CRUDE OIL, CONTAMINANTS, MONITORING, FUEL OIL, PATENT, *OPTICAL SENSOR,
1071 DETECTION, REMOTE SENSING, OIL SLICKS, USGS, *LANDSAT IMAGERY,
1075 DETECTION, DESIGN-ENGINEERING, REMOTE SENSING, OIL SLICKS, OCEANS,
1079 DETECTION, REMOTE SENSING, OIL SLICKS, *LASERS, OCEANS,
1080 DETECTION, COASTS, REMOTE SENSING, OIL SPILLS, MODELS, POLLUTION PREVENTION, *LINEAR PROGRAMMING,
1097 DETECTION, CHEMICAL ANALYSIS, WASTEWATERS, *OIL TRACES, *ADSORPTION POLAROGRAPHY,
1112 DETECTION, ANALYTICAL TECHNIQUES, PETROLEUM PRODUCTS, SEAWATER, *NAPHTHENIC ACIDS,
1118 DETECTION, CRANKCASE OIL, CHEMICAL ANALYSIS, WASTEWATERS, HYDROCARBONS, MARINE ORGANISMS, NEW YORK,
1334 DETECTION, LEAKAGE, PIPELINES, PATENT, *ACOUSTIC LEAK DETECTION,
1337 DETECTION, BEAUFORT SEA, SPILL CLEANUP, POLLUTION CONTROL, MONITORING, DISPOSAL, *EQUIPMENT EVALUATION,
1340 DETECTION, BEHAVIOR, ARCTIC, SPILL CLEANUP, DISPOSAL, *ARCTIC MARINE OIL SPILL PROGRAM,
1227 DEVELOPMENT, ALASKA, PIPELINES, ENVIRONMENTAL EFFECTS, OIL SPILLS, LEGISLATION, LIABILITY,
1294 DEVELOPMENT, CANADA, TAR SANDS, WASTEWATER DISPOSAL, WATER QUALITY,
1470 DEVELOPMENT, COASTS, BIRDS, ALASKA, OIL FIELDS, ENVIRONMENTAL PROTECTION, PRUDHOE BAY, *TUNDRA WETLANDS,
1509 DEVELOPMENT, OIL INDUSTRY, REFINERIES, PETROCHEMICALS, ENVIRONMENTAL EFFECTS,
1521 DEVELOPMENT, OFFSHORE PRODUCTION, ENVIRONMENTAL EFFECTS, US, OIL SHALE,
1537 DEVELOPMENT, OIL SHALE, PRODUCTION, ECONOMICS, ENVIRONMENTAL EFFECTS,
1538 DEVELOPMENT, OIL SHALE, ENVIRONMENTAL EFFECTS, *RESEARCH PROGRAMS,
1543 DEVELOPMENT, OIL SHALE, ECONOMICS, ENVIRONMENTAL EFFECTS,
1150 DISPERSANTS, SOUTH AFRICA, SPILL CLEANUP, TOXICITY, MARINE ORGANISMS,
1159 DISPERSANTS, SPILL CLEANUP, EMULSIONS, SURFACTANTS, PATENT,
1163 DISPERSANTS, SPILL CLEANUP, TOXICITY, ENGLAND,
1393 DISPERSANTS, CRUDE OIL, BIOLOGICAL EFFECTS, POLYCHAETES, UK, *ARENICOLA MARINA L, *MILFORD HAVEN,
1430 DISPERSANTS, CRUDE OIL, TOXICITY, FUEL OIL, EMULSIONS, MOLLUSKS, UK,
1433 DISPERSANTS, ACUTE EFFECTS, TOXICITY, FISH, SOLVENTS, *FISH LARVAE,
1442 DISPERSANTS, CONTAMINATION, OIL INDUSTRY, HYDROCARBONS, *AQUATIC POLLUTION,
1449 DISPERSANTS, CONTAMINATION, BIOLOGICAL EFFECTS, OIL DISCHARGES, SHIPS, TANKERS, FATE,
1453 DISPERSANTS, SPILL CLEANUP, URQUIOLA SPILL, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, SPAIN,
1457 DISPERSANTS, CONTAMINATION, OIL SPILLS, REFINERIES, TOXICITY, MONITORING, *BOOK REVIEW,
1078 DISPERSIONS, REMOTE SENSING, WASTEWATERS, ESTUARIES, OCS, *CURRENT CIRCULATION,
1120 DISPERSIONS, DESIGN-ENGINEERING, HYDROCARBONS, *PETROLEUM BIOASSAY, *CONTINUOUS FLOW SYSTEM,
1187 DISPERSIONS, SPILL CLEANUP, PATENT, *ASBESTOS MINE WASTES,
1248 DISPERSIONS, COALESCENCE, OIL-WATER SEPARATION, PATENT, *BROMINATED POLYETHYLENE GRANULES,
1275 DISPERSIONS, COALESCENCE, OIL-WATER SEPARATION, HYDROCARBONS, PATENT,
1351 DISPERSIONS, CRUDE OIL, FUEL OIL, TOXICITY, MOLLUSKS, *OYSTER, *CRASSOSTREA, VIRGINICA,
1562 DISPERSIONS, BIODEGRADATION, BACTERIA, OIL SPILLS, FATE, EMULSIFICATION, WEATHERING,
1582 DISPERSIONS, OFFSHORE DRILLING, OIL SPILLS, FATE, EVAPORATION, SPILL RECOVERY, NORTH SEA, *EKOFISK WELL BLOWOUT,
1587 DISPERSIONS, MODELS, FATE, OCEANS, SPILL CONTAINMENT, ENVIRONMENTAL EFFECTS, MARINE ORGANISMS,
1006 DISPOSAL, WASTE OIL, ECONOMICS, HEALTH HAZARDS, UK,
1168 DISPOSAL, ABSORPTION, SPILL CLEANUP, *COTTON SORBENT,
1240 DISPOSAL, DESIGN-ENGINEERING, SLUDGE, REFINERIES, INCINERATION, *FLUID BED INCINERATION,

1242 DISPOSAL, CONTAMINANTS, WASTEWATER TREATMENT, PETROLEUM PRODUCTS,
1250 DISPOSAL, WASTE OIL, SOURCES, ENVIRONMENTAL EFFECTS, RECLAMATION, ECONOMIC EFFECTS,
1254 DISPOSAL, WASTE OIL TREATMENT, *WASTE MANAGEMENT,
1255 DISPOSAL, WASTE OIL TREATMENT, RECLAMATION, USN,
1261 DISPOSAL, SLUDGE, REFINERIES, WASTEWATER TREATMENT, *SLUDGE DEWATERING,
1276 DISPOSAL, DESIGN-ENGINEERING, COST ANALYSIS, SLUDGE, SOLID WASTES, INCINERATION,
1288 DISPOSAL, WASTEWATERS, SOLID WASTES, INDUSTRIES, OIL INDUSTRY,
1290 DISPOSAL, CONTAMINANTS, CHEMICAL ANALYSIS, WASTEWATER TREATMENT, REFINERIES,
1305 DISPOSAL, WASTE OIL, RECYCLING, OIL-WATER SEPARATION, SLUDGE,
1336 DISPOSAL, BEAUFORT SEA, BEACHES, SPILL CLEANUP, OIL WELLS, POLLUTION CONTROL, RESTORATION,
1337 DISPOSAL, DETECTION, BEAUFORT SEA, SPILL CLEANUP, POLLUTION CONTROL, MONITORING, *EQUIPMENT EVALUATION,
1340 DISPOSAL, DETECTION, BEHAVIOR, ARCTIC, SPILL CLEANUP, *ARCTIC MARINE OIL SPILL PROGRAM,
1496 DISPOSAL, OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS, MARINE ORGANISMS, *DRILLING WASTES,
1527 DISPOSAL, COLORADO, OIL SHALE, EXTRACTION, EIS, SOLID WASTES, RESTORATION,
1032 DISTRIBUTION, BENTHOS, MONITORING, MARINE ORGANISMS, SEDIMENTS, UK, *SUBLITTORAL MACROFAUNA, *MILFORD HAVEN,
1040 DISTRIBUTION, BERING SEA, BASELINE STUDIES, MONITORING, HYDROCARBONS, OCS, OFFSHORE DEVELOPMENT, *NATURALLY-OCCURRING HYDROCARBONS,
1062 DISTRIBUTION, BASELINE STUDIES, ALASKA, MONITORING, HYDROCARBONS, FATE, OCS,
1070 DISTRIBUTION, COASTS, BEAUFORT SEA, MONITORING, TAR, SOURCES,
1082 DISTRIBUTION, BIOLOGICAL EFFECTS, ATLANTIC COAST, SAMPLING, MICROORGANISMS, SEAWATER, SEDIMENTS, OFFSHORE DRILLING,
1099 DISTRIBUTION, CHEMICAL ANALYSIS, BENTHOS, HYDROCARBONS, OCS, TEXAS, MEXICO/GULF OF,
1469 DISTRIBUTION, BIOLOGICAL EFFECTS, BEAUFORT SEA, BASELINE STUDIES, MONITORING, ESTUARIES, FISHERIES, OFFSHORE DEVELOPMENT,
1473 DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, MARINE MAMMALS, OFFSHORE DEVELOPMENT, *SPOTTED SEAL,
1474 DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BEAUFORT SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT, MARINE MAMMALS, HABITAT, ICE,
1475 DISTRIBUTION, BIOLOGICAL EFFECTS, ALASKA/GULF OF, OFFSHORE DEVELOPMENT, MARINE MAMMALS, *SEA LIONS, *ECOLOGY, *TROPHIC STRUCTURE,
1477 DISTRIBUTION, BIOLOGICAL EFFECTS, BENTHOS, BEAUFORT SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT,
1479 DISTRIBUTION, BERING SEA, BEAUFORT SEA, BASELINE STUDIES, ZOOPLANKTON, *MICRONEKTON, OFFSHORE DEVELOPMENT,
1480 DISTRIBUTION, BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA/GULF OF, ZOOPLANKTON, MONITORING, OFFSHORE DEVELOPMENT,
1481 DISTRIBUTION, BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA/GULF OF, MONITORING, PLANKTON, *ICHTHYOPLANKTON, OFFSHORE DEVELOPMENT,
1482 DISTRIBUTION, BIBLIOGRAPHIES, BEAUFORT SEA, BASELINE STUDIES, MONITORING, PLANKTON,
1484 DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BENTHOS, ALASKA/GULF OF, *PRODUCTIVITY, OFFSHORE DEVELOPMENT,
1485 DISTRIBUTION, BIOLOGICAL EFFECTS, BENTHOS, BASELINE STUDIES, ALASKA/GULF OF, MONITORING, *PRODUCTIVITY, STATISTICAL ANALYSIS, OFFSHORE DEVELOPMENT,
1487 DISTRIBUTION, BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA/GULF OF, MARINE MAMMALS, OFFSHORE DEVELOPMENT,
1488 DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BEAUFORT SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT, OIL-GAS LEASING, OIL SPILLS, MARINE MAMMALS,
1489 DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT, MARINE MAMMALS, *WHALES,
1490 DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT, OIL-GAS LEASING, MARINE MAMMALS,
1495 DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BEAUFORT SEA, OFFSHORE DEVELOPMENT, MARINE MAMMALS, OCS, *SEALS, *TROPHIC STRUCTURE,
1498 DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, MONITORING, MARINE ORGANISMS, OFFSHORE DEVELOPMENT,
1501 DISTRIBUTION, BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA, MARINE MAMMALS, OFFSHORE DEVELOPMENT, *SEA OTTERS,
1502 DISTRIBUTION, CONTAMINATION, ALASKA, MARINE MAMMALS, HABITAT, OFFSHORE DEVELOPMENT, *SEA OTTERS,
1505 DISTRIBUTION, COASTS, CHRONIC EFFECTS, BERING SEA, BASELINE STUDIES, ALASKA/GULF OF, ACUTE EFFECTS, MONITORING, MARINE ORGANISMS, INTERTIDAL ZONE,
1584 DISTRIBUTION, BIOLOGICAL EFFECTS, OIL SPILLS, FATE, HYDROCARBONS, MARSHES, METABOLISM, MARINE ORGANISMS, MASSACHUSETTS,
1630 DISTRIBUTION, BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, BEAUFORT SEA, FISH, OFFSHORE DEVELOPMENT,
1438 DRIFT, OIL SLICKS, FATE, OCEANS, *WAVE DAMPING, *WIND WAVE TUNNEL,
1570 DRIFT, OIL SLICKS, SPREADING, PHYSICAL EFFECTS, WEATHERING,
1600 DRIFT, MODELS, OIL SPILLS, MOVEMENT, *COMPUTER MODELING,
1263 DRILLING, BIODEGRADATION, BACTERIA, OIL WELLS, WASTEWATER TREATMENT, FLOCCULATION, PATENT,

1331 DRILLING, CONTINGENCY PLANNING, POLLUTION PREVENTION, OIL DISCHARGES, REGULATIONS, EPA, *NAVIGABLE WATERS,
1504 DRILLING, ARCTIC, ACUTE EFFECTS, OIL WELLS, TOXICITY, FISH, *TROUT, *DRILLING MUDS,
1506 DRILLING, OIL WELLS, TOXICITY, ENVIRONMENTAL EFFECTS, FISH, *SALMON, *DRILLING MUDS,
1403 ECHINODERMS, CRUDE OIL, TOXICITY, FUEL OIL, MARINE ORGANISMS, *SAND DOLLARS,
1028 ECONOMIC EFFECTS, CONTAMINATION, WASTEWATERS, REFINERIES, INDUSTRIES, SOURCES, INFORMATION SYSTEMS,
1217 ECONOMIC EFFECTS, CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, FEA, *STRATEGIC PETROLEUM RESERVE,
1250 ECONOMIC EFFECTS, DISPOSAL, WASTE OIL, SOURCES, ENVIRONMENTAL EFFECTS, RECLAMATION,
1316 ECONOMIC EFFECTS, CONSERVATION, WASTE OIL, RECLAMATION, ENVIRONMENTAL EFFECTS, UK,
1440 ECONOMIC EFFECTS, REFINERIES, WASTEWATERS, POLLUTION CONTROL, MODELS, *INDUSTRY COSTS,
1508 ECONOMIC EFFECTS, CONTAMINATION, OFFSHORE DEVELOPMENT, FISHERIES, FRANCE,
1541 ECONOMIC EFFECTS, ALASKA, OFFSHORE DEVELOPMENT, SOCIAL EFFECTS,
1006 ECONOMICS, DISPOSAL, WASTE OIL, HEALTH HAZARDS, UK,
1115 ECONOMICS, MODELS, TANKERS, OIL SPILLS, ENVIRONMENTAL EFFECTS, *OPTIMAL TANKER SIZE,
1147 ECONOMICS, SPILL CLEANUP, ENVIRONMENTAL PROTECTION, OFFSHORE DEVELOPMENT, SAFETY, NORTH SEA, NORWAY,
1207 ECONOMICS, ALASKA/GULF OF, OIL TRANSPORT, OCS, OIL SPILLS, STORAGE, TANKERS, PIPELINES, OIL TANKS, *RISK ANALYSIS,
1219 ECONOMICS, TANKERS, OIL TRANSPORT, OIL DISCHARGES, OIL SPILLS, ENVIRONMENTAL EFFECTS, *SUPERTANKERS,
1239 ECONOMICS, WASTEWATER TREATMENT, EMULSIONS, FILTRATION, *ULTRAFILTRATION MEMBRANE,
1528 ECONOMICS, OFFSHORE PRODUCTION, SAFETY, ENVIRONMENTAL PROTECTION, POLLUTION PREVENTION,
1537 ECONOMICS, DEVELOPMENT, OIL SHALE, PRODUCTION, ENVIRONMENTAL EFFECTS,
1543 ECONOMICS, DEVELOPMENT, OIL SHALE, ENVIRONMENTAL EFFECTS,
1421 ECOSYSTEMS, COASTS, WASTEWATERS, INDUSTRIES, HYDROCARBONS, MARINE ORGANISMS,
1452 ECOSYSTEMS, CONTAMINANTS, BALTIC SEA, HYDROCARBONS, ENVIRONMENTAL EFFECTS,
1493 ECOSYSTEMS, BENTHOS, OFFSHORE DEVELOPMENT, PLANKTON, OCS, ENVIRONMENTAL EFFECTS,
1208 EIS, CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, *SALT DOMES, *TANK FARMS, *STRATEGIC PETROLEUM RESERVE,
1209 EIS, CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, LOUISIANA, *BAYOU CHOCTAW SALT DOME,
1210 EIS, CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, OIL TRANSPORT, WATER QUALITY, *BRYAN MOUND SALT DOMES,
1211 EIS, CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, WATER QUALITY, OIL SPILLS, KENTUCKY, *CENTRAL ROCK MINE,
1212 EIS, CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, WATER QUALITY, OIL SPILLS, LOUISIANA, *COTE BLANCHE MINE,
1213 EIS, CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, WATER QUALITY, OIL SPILLS, OHIO, *IRONTON MINE,
1214 EIS, CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, WATER QUALITY, OIL SPILLS, TEXAS, *KLEER MINE,
1215 EIS, CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, WATER QUALITY, OIL SPILLS, LOUISIANA, *WEEKS ISLAND MINE,
1216 EIS, CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, OIL TRANSPORT, WATER QUALITY, *WEST HACKBERRY SALT DOME,
1478 EIS, BIOLOGICAL EFFECTS, ATLANTIC OCEAN, OFFSHORE PRODUCTION, OCS, *GEORGES BANK,
1512 EIS, PORTS, REGULATIONS, ENVIRONMENTAL EFFECTS, OIL DISCHARGES, SAFETY, *DEEPWATER PORT,
1514 EIS, CALIFORNIA COAST, OIL-GAS LEASING, OCS, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT,
1524 EIS, BLM, ATLANTIC OCEAN, ARGO MERCHANT SPILL, OIL-GAS LEASING, ENVIRONMENTAL EFFECTS, FISHERIES, *GEORGES BANK,
1527 EIS, DISPOSAL, COLORADO, OIL SHALE, EXTRACTION, SOLID WASTES, RESTORATION,
1596 EIS, ATLANTIC COAST, FATE, OIL TRANSPORT, OCS, *SUSPENDED MATTER,
1562 EMULSIFICATION, DISPERSIONS, BIODEGRADATION, BACTERIA, OIL SPILLS, FATE, WEATHERING,
1193 EMULSIFIERS, SOLVENTS, SURFACTANTS, TOXICITY, PHYTOPLANKTON,
1427 EMULSIFIERS, TOXICITY, PHYTOPLANKTON, MARINE ORGANISMS,
1159 EMULSIONS, DISPERSANTS, SPILL CLEANUP, SURFACTANTS, PATENT,
1191 EMULSIONS, ABSORPTION, PATENT, *POLYURETHANE FOAM CHIPS,
1228 EMULSIONS, OIL-WATER SEPARATION, PATENT, *DEMULSIFICATION,
1229 EMULSIONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, SLUDGE,
1232 EMULSIONS, BILGES, WASTE OIL TREATMENT, OIL TANKS, SPILL RECOVERY, *DEMULSIFYING AGENTS,
1234 EMULSIONS, WASTE OIL DISPOSAL, OIL-WATER SEPARATION, FILTRATION,
1237 EMULSIONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, PH CONTROL, PATENT, *ZN SALTS,
1239 EMULSIONS, ECONOMICS, WASTEWATER TREATMENT, FILTRATION, *ULTRAFILTRATION MEMBRANE,
1245 EMULSIONS, COALESCENCE, WASTEWATER TREATMENT, OIL-WATER SEPARATION,
1246 EMULSIONS, DESIGN-ENGINEERING, COALESCENCE, OIL-WATER SEPARATION,
1252 EMULSIONS, WASTEWATER TREATMENT, FUELS, OIL-WATER SEPARATION, PATENT,
1257 EMULSIONS, DESIGN-ENGINEERING, COALESCENCE, OIL-WATER SEPARATION, PATENT, *METAL CATALYSTS,
1258 EMULSIONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, *AERATION, FLOTATION, PATENT,
1260 EMULSIONS, OIL-WATER SEPARATION, COAGULATION, FILTRATION, PATENT,
1265 EMULSIONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, *CELLULOSE FIBERS, PATENT,

1266 EMULSIONS, DESIGN-ENGINEERING, WASTEWATER TREATMENT, FILTRATION, PH CONTROL, PATENT,
1269 EMULSIONS, COALESCENCE, OIL-WATER SEPARATION, FILTRATION, PATENT,
1273 EMULSIONS, BILGES, SHIPS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, *DEMULSIFICATION,
1281 EMULSIONS, COALESCENCE, OIL-WATER SEPARATION, FLOTATION, FILTRATION, PATENT, *MAGNETIC POWDER,
1287 EMULSIONS, WASTEWATER TREATMENT, SLUDGE, PH CONTROL, FLOTATION, COAGULATION, *AERATION,
1291 EMULSIONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, OXIDATION, PATENT,
1292 EMULSIONS, COALESCENCE, OIL-WATER SEPARATION, *FIBROUS BED COALESCERS,
1299 EMULSIONS, WASTEWATER TREATMENT, REFINERIES, OIL-WATER SEPARATION, FLOTATION, SKIMMERS,
1300 EMULSIONS, COALESCENCE, BILGES, WASTEWATER TREATMENT, OIL-WATER SEPARATION, *PEAT,
1303 EMULSIONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, REFINERIES, PATENT, *POLYVINYL CHLORIDE,
1306 EMULSIONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, PH CONTROL, FLOTATION, PATENT,
1430 EMULSIONS, DISPERSANTS, CRUDE OIL, TOXICITY, FUEL OIL, MOLLUSKS, UK,
1015 ENGLAND, CONTAMINATION, COASTS, BIRDS, OIL SLICKS, RESTORATION,
1163 ENGLAND, DISPERSANTS, SPILL CLEANUP, TOXICITY,
1315 ENGLAND, WASTE OIL, LUBRICATING OIL, RECYCLING,
1021 ENVIRONMENTAL DETERIORATION, STATISTICS, OIL SPILLS, JAPAN, *SETO INLAND SEA,
1364 ENVIRONMENTAL DETERIORATION, OIL SPILLS, VEGETATION, WASHINGTON, *ALPINE MEADOW,
1013 ENVIRONMENTAL EFFECTS, ARGO MERCHANT SPILL, FISHERIES, OLYMPIC GAMES SPILL,
1022 ENVIRONMENTAL EFFECTS, ARGO MERCHANT SPILL, TANKERS, FISHERIES, SPILL CLEANUP, LIABILITY,
1023 ENVIRONMENTAL EFFECTS, OIL SPILLS, FUEL OIL, SPILL CLEANUP, MOVEMENT, JAPAN, *INLAND SEA,
1025 ENVIRONMENTAL EFFECTS, ARGO MERCHANT SPILL, TANKERS, *LIBERIAN FLAG OF CONVENIENCE,
1035 ENVIRONMENTAL EFFECTS, BASELINE STUDIES, MONITORING, SEDIMENTS, MOLLUSKS, PUGET SOUND, OIL SPILLS, NOAA,
1038 ENVIRONMENTAL EFFECTS, COASTS, BASELINE STUDIES, ALASKA, MONITORING, *STREAMFLOW, ESTUARIES, OFFSHORE DEVELOPMENT, OIL SPILLS,
1047 ENVIRONMENTAL EFFECTS, ALASKA/GULF OF, MONITORING, OCEANS, *CIRCULATION PATTERNS, OCS, OFFSHORE DEVELOPMENT,
1061 ENVIRONMENTAL EFFECTS, BERING SEA, BEAUFORT SEA, BASELINE STUDIES, ALASKA/GULF OF, MONITORING, *MARINE CLIMATOLOGY, OFFSHORE DEVELOPMENT,
1072 ENVIRONMENTAL EFFECTS, CONTINGENCY PLANNING, ALASKA, REMOTE SENSING, OCS, OFFSHORE DEVELOPMENT, FATE, OIL SPILLS,
1115 ENVIRONMENTAL EFFECTS, ECONOMICS, MODELS, TANKERS, OIL SPILLS, *OPTIMAL TANKER SIZE,
1173 ENVIRONMENTAL EFFECTS, COASTS, CANADA, SPILL CLEANUP, RESTORATION,
1206 ENVIRONMENTAL EFFECTS, OIL TRANSFER, PORTS, OIL DISCHARGES, MARINE ORGANISMS, UK, *MILFORD HAVEN,
1208 ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, *SALT DOMES, *TANK FARMS, *STRATEGIC PETROLEUM RESERVE,
1209 ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, LOUISIANA, *BAYOU CHOCTAW SALT DOME,
1210 ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, OIL TRANSPORT, WATER QUALITY, *BRYAN MOUND SALT DOMES,
1211 ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, WATER QUALITY, OIL SPILLS, KENTUCKY, *CENTRAL ROCK MINE,
1212 ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, WATER QUALITY, OIL SPILLS, LOUISIANA, *COTE BLANCHE MINE,
1213 ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, WATER QUALITY, OIL SPILLS, OHIO, *IRONTON MINE,
1214 ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, WATER QUALITY, OIL SPILLS, TEXAS, *KLEER MINE,
1215 ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, WATER QUALITY, OIL SPILLS, LOUISIANA, *WEEKS ISLAND MINE,
1216 ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, OIL TRANSPORT, WATER QUALITY, *WEST HACKBERRY SALT DOME,
1217 ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, CRUDE OIL, STORAGE, FEA, *STRATEGIC PETROLEUM RESERVE,
1218 ENVIRONMENTAL EFFECTS, ALASKA, OIL TRANSPORT, OIL SPILLS, TANKERS, *VALDEZ NARROWS,
1219 ENVIRONMENTAL EFFECTS, ECONOMICS, TANKERS, OIL TRANSPORT, OIL DISCHARGES, OIL SPILLS, *SUPERTANKERS,
1222 ENVIRONMENTAL EFFECTS, COST ANALYSIS, OIL TRANSFER, OFFSHORE DEVELOPMENT, SOCIO-ECONOMIC EFFECTS, MODELS, SPREADING,
1224 ENVIRONMENTAL EFFECTS, ALASKA, OIL TRANSPORT, TANKERS, PORTS, OIL SPILLS, *VALDEZ NARROWS,
1227 ENVIRONMENTAL EFFECTS, DEVELOPMENT, ALASKA, PIPELINES, OIL SPILLS, LEGISLATION, LIABILITY,
1250 ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, DISPOSAL, WASTE OIL, SOURCES, RECLAMATION,
1316 ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, CONSERVATION, WASTE OIL, RECLAMATION, UK,
1329 ENVIRONMENTAL EFFECTS, CRUDE OIL, FATE, POLLUTION PREVENTION, OFFSHORE DRILLING, OIL TRANSPORT, SPILL CLEANUP, NORTH SEA,
1335 ENVIRONMENTAL EFFECTS, OIL INDUSTRY, LEGISLATION, UK, MONITORING, OIL SPILLS, WASTEWATERS,
1342 ENVIRONMENTAL EFFECTS, POLLUTION PREVENTION, REFINING, OIL TRANSPORT, OIL SPILLS, OIL INDUSTRY,

ORGANISMS,
1626 ENVIRONMENTAL EFFECTS, BIBLIOGRAPHIES, PIPELINES, OIL TRANSPORT, OFFSHORE DEVELOPMENT,
1026 ENVIRONMENTAL PROTECTION, BALTIC SEA, UK, USSR, *JOINT UK/USSR COMMITTEE,
1048 ENVIRONMENTAL PROTECTION, MONITORING, OIL DISCHARGES, OIL INDUSTRY, GOVERNMENT AGENCIES,
1147 ENVIRONMENTAL PROTECTION, ECONOMICS, SPILL CLEANUP, OFFSHORE DEVELOPMENT, SAFETY, NORTH SEA, NORWAY,
1205 ENVIRONMENTAL PROTECTION, COST ANALYSIS, POLLUTION CONTROL, TANKERS, SEGREGATED BALLAST , REGULATIONS, USCG,
1470 ENVIRONMENTAL PROTECTION, DEVELOPMENT, COASTS, BIRDS, ALASKA, OIL FIELDS, PRUDHOE BAY, *TUNDRA WETLANDS,
1528 ENVIRONMENTAL PROTECTION, ECONOMICS, OFFSHORE PRODUCTION, SAFETY, POLLUTION PREVENTION,
1606 ENVIRONMENTAL PROTECTION, LEGISLATION, US, OFFSHORE DEVELOPMENT, OIL-GAS LEASING, ONSHORE IMPACTS, *OCS LANDS ACT AMENDMENTS,
1122 EPA, SPILL CLEANUP, US, STATISTICAL ANALYSIS, USCG, INFORMATION SYSTEMS,
1331 EPA, DRILLING, CONTINGENCY PLANNING, POLLUTION PREVENTION, OIL DISCHARGES, REGULATIONS, *NAVIGABLE WATERS,
1609 EPA, LEGISLATION, US, WATER QUALITY, PRODUCTION, *UNDERGROUND INJECTION,
1037 ESTUARIES, CONTAMINANTS, COASTS, MONITORING, *METHODS, *INDICATOR ORGANISMS,
1038 ESTUARIES, ENVIRONMENTAL EFFECTS, COASTS, BASELINE STUDIES, ALASKA, MONITORING, *STREAMFLOW, OFFSHORE DEVELOPMENT, OIL SPILLS,
1052 ESTUARIES, CONTAMINATION, MONITORING, METABOLISM, MOLLUSKS, HYDROCARBONS, *ADENYLATE ENERGY CHARGE, *ENVIRONMENTAL STRESS,
1078 ESTUARIES, DISPERSIONS, REMOTE SENSING, WASTEWATERS, OCS, *CURRENT CIRCULATION,
1085 ESTUARIES, ALABAMA, SAMPLING, HYDROCARBONS, SEDIMENTS, OCS, OIL SPILLS, TOXICITY, MISSISSIPPI,
1349 ESTUARIES, OIL SPILLS, DELAWARE RIVER, TOXICITY, FISH, *CORINTHOS SPILL,
1469 ESTUARIES, DISTRIBUTION, BIOLOGICAL EFFECTS, BEAUFORT SEA, BASELINE STUDIES, MONITORING, FISHERIES, OFFSHORE DEVELOPMENT,
1544 ESTUARIES, CRUDE OIL, BIODEGRADATION, MICROORGANISMS, MARSHES,
1565 ESTUARIES, BIODEGRADATION, BACTERIA, HYDROCARBONS, METABOLISM, *CYCLOHEXANE,
1568 ESTUARIES, CRUDE OIL, BIODEGRADATION, BACTERIA, MICROORGANISMS,
1631 ESTUARIES, CONTAMINATION, COASTS, BIBLIOGRAPHIES,
1616 EUROPE, INTERNATIONAL CONVENTIONS, POLLUTION CONTROL, REGULATIONS, LIABILITY, OFFSHORE DEVELOPMENT, NORTH SEA,
1223 EVAPORATION, OIL TRANSPORT, PIPELINES, OIL SPILLS, LEAKAGE, FATE, SPREADING, MODELS, *IGNITION HAZARDS,
1572 EVAPORATION, CRUDE OIL, OIL SPILLS, MODELS, SOLUTION, HYDROCARBONS, TOXICITY,
1582 EVAPORATION, DISPERSIONS, OFFSHORE DRILLING, OIL SPILLS, FATE, SPILL RECOVERY, NORTH SEA, *EKOFISK WELL BLOWOUT,
1095 EXTRACTION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, HYDROCARBONS, SOLVENTS, SPECTROMETRY,
1105 EXTRACTION, ANALYTICAL TECHNIQUES, PETROLEUM PRODUCTS, *GRAVIMETRIC DETERMINATION, SOLVENTS,
1109 EXTRACTION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, PAH, *FLUORESCENCE,
1526 EXTRACTION, ENVIRONMENTAL EFFECTS, COASTS, OFFSHORE PRODUCTION, FATE, HYDROCARBONS, *PRODUCED WATERS,
1527 EXTRACTION, EIS, DISPOSAL, COLORADO, OIL SHALE, SOLID WASTES, RESTORATION,
1031 FATE, CONTAMINANTS, BEAUFORT SEA, BASELINE STUDIES, MONITORING, *OCEAN CURRENTS, OCS, OFFSHORE DEVELOPMENT,
1059 FATE, CONTAMINANTS, COASTS, BASELINE STUDIES, ALASKA, MONITORING, *WIND CONDITIONS, OFFSHORE DEVELOPMENT,
1060 FATE, CONTAMINANTS, BASELINE STUDIES, ALASKA/GULF OF, MONITORING, *OCEAN CURRENTS, OFFSHORE DEVELOPMENT,
1062 FATE, DISTRIBUTION, BASELINE STUDIES, ALASKA, MONITORING, HYDROCARBONS, OCS,
1072 FATE, ENVIRONMENTAL EFFECTS, CONTINGENCY PLANNING, ALASKA, REMOTE SENSING, OCS, OFFSHORE DEVELOPMENT, OIL SPILLS,
1083 FATE, SAMPLING, HYDROCARBONS, OCEANS,
1203 FATE, BIOLOGICAL EFFECTS, OIL TRANSPORT, OIL DISCHARGES, SOURCES, MARINE ORGANISMS, FISHERIES, PACIFIC OCEAN,
1223 FATE, EVAPORATION, OIL TRANSPORT, PIPELINES, OIL SPILLS, LEAKAGE, SPREADING, MODELS, *IGNITION HAZARDS,
1329 FATE, ENVIRONMENTAL EFFECTS, CRUDE OIL, POLLUTION PREVENTION, OFFSHORE DRILLING, OIL TRANSPORT, SPILL CLEANUP, NORTH SEA,
1438 FATE, DRIFT, OIL SLICKS, OCEANS, *WAVE DAMPING, *WIND WAVE TUNNEL,
1444 FATE, BIOLOGICAL EFFECTS, ATLANTIC OCEAN, ARGO MERCHANT SPILL, MARINE ORGANISMS,
1449 FATE, DISPERSANTS, CONTAMINATION, BIOLOGICAL EFFECTS, OIL DISCHARGES, SHIPS, TANKERS,
1459 FATE, ENVIRONMENTAL EFFECTS, CONTAMINANTS, BIOLOGICAL EFFECTS, REGULATIONS, *BOOK REVIEW,
1526 FATE, EXTRACTION, ENVIRONMENTAL EFFECTS, COASTS, OFFSHORE PRODUCTION, HYDROCARBONS, *PRODUCED WATERS,
1540 FATE, OIL WELLS, *SUBMARINE BLOWOUT SIMULATION, MODELS, CONTAINMENT,
1562 FATE, EMULSIFICATION, DISPERSIONS, BIODEGRADATION, BACTERIA, OIL SPILLS, WEATHERING,
1579 FATE, CONTAMINATION, BIOLOGICAL EFFECTS, ATLANTIC OCEAN, ARGO MERCHANT SPILL, FUEL OIL, MARINE ORGANISMS, NOAA,
1581 FATE, CONTAMINATION, ATLANTIC OCEAN, ARGO MERCHANT SPILL, FUEL OIL, MARINE ORGANISMS,

1355 ENVIRONMENTAL EFFECTS, ATLANTIC COAST, OIL SPILLS, SHORELINES, *WWII SPILLS,

1357 ENVIRONMENTAL EFFECTS, PORTS, OIL SPILLS, WASTEWATERS, REFINERIES, MARINE ORGANISMS, UK, *MILFORD HAVEN,

1376 ENVIRONMENTAL EFFECTS, ARCTIC, ALASKA, OIL SPILLS, MARINE ORGANISMS, *PRUDHOE BAY,

1386 ENVIRONMENTAL EFFECTS, ATLANTIC COAST, OIL SPILLS, WWII SPILLS, TANKERS, MOVEMENT,

1392 ENVIRONMENTAL EFFECTS, BIODEGRADATION, BACTERIA, REFINERIES, WASTEWATERS, MARINE ORGANISMS, PHYTOPLANKTON, FRANCE,

1446 ENVIRONMENTAL EFFECTS, CONTAMINATION, OCEANS, WATER QUALITY, OFFSHORE EXPLORATION,

1448 ENVIRONMENTAL EFFECTS, CRUDE OIL, SEDIMENTS, OFFSHORE DEVELOPMENT, RELEASE, MICROORGANISMS, *TRACE METALS,

1451 ENVIRONMENTAL EFFECTS, OIL TRANSFER, PORTS, POLLUTION PREVENTION, LEAKAGE, SPILL CLEANUP, UK, *MILFORD HAVEN,

1452 ENVIRONMENTAL EFFECTS, ECOSYSTEMS, CONTAMINANTS, BALTIC SEA, HYDROCARBONS,

1453 ENVIRONMENTAL EFFECTS, DISPERSANTS, SPILL CLEANUP, URQUIOLA SPILL, MARINE ORGANISMS, SPAIN,

1454 ENVIRONMENTAL EFFECTS, CRUDE OIL, METULA SPILL, MAGELLAN/STRAIT OF,

1459 ENVIRONMENTAL EFFECTS, CONTAMINANTS, BIOLOGICAL EFFECTS, FATE, REGULATIONS, *BOOK REVIEW,

1461 ENVIRONMENTAL EFFECTS, BENTHOS, SEDIMENTATION, OIL SPILLS, *ANIMAL-SEDIMENT RELATIONSHIPS,

1462 ENVIRONMENTAL EFFECTS, CHINA, OIL SPILLS, FISHERIES, PLANKTON, MONITORING, *HONG KONG,

1464 ENVIRONMENTAL EFFECTS, COASTS, BASELINE STUDIES, OIL SPILLS, *COASTAL IMPACTS,

1468 ENVIRONMENTAL EFFECTS, API, OFFSHORE PRODUCTION, PLATFORMS, MARINE ORGANISMS, NATURAL SEEPAGE,

1491 ENVIRONMENTAL EFFECTS, BENTHOS, BASELINE STUDIES, ALASKA, SEDIMENTS, MONITORING, OCS, OFFSHORE DEVELOPMENT,

1493 ENVIRONMENTAL EFFECTS, ECOSYSTEMS, BENTHOS, OFFSHORE DEVELOPMENT, PLANKTON, OCS,

1496 ENVIRONMENTAL EFFECTS, DISPOSAL, OFFSHORE DRILLING, MARINE ORGANISMS, *DRILLING WASTES,

1497 ENVIRONMENTAL EFFECTS, BERING SEA, BEAUFORT SEA, BASELINE STUDIES, ALASKA/GULF OF, MONITORING, FISH, OFFSHORE DEVELOPMENT, OCS, *FISH DISEASES,

1506 ENVIRONMENTAL EFFECTS, DRILLING, OIL WELLS, TOXICITY, FISH, *SALMON, *DRILLING MUDS,

1509 ENVIRONMENTAL EFFECTS, DEVELOPMENT, OIL INDUSTRY, REFINERIES, PETROCHEMICALS,

1511 ENVIRONMENTAL EFFECTS, *ENERGY CONSERVATION, INDUSTRIES, REFINERIES, *TECHNOLOGY INNOVATION,

1512 ENVIRONMENTAL EFFECTS, EIS, PORTS, REGULATIONS, OIL DISCHARGES, SAFETY, *DEEPWATER PORT,

1513 ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, PLATFORMS, REGULATIONS, OIL INDUSTRY,

1514 ENVIRONMENTAL EFFECTS, EIS, CALIFORNIA COAST, OIL-GAS LEASING, OCS, OFFSHORE DEVELOPMENT,

1515 ENVIRONMENTAL EFFECTS, ATLANTIC COAST, OFFSHORE DEVELOPMENT, OIL INDUSTRY, OIL WELLS, OCS,

1516 ENVIRONMENTAL EFFECTS, PRODUCTION, *TERTIARY OIL RECOVERY METHODS, GROUNDWATER, WATER QUALITY, MODELS,

1517 ENVIRONMENTAL EFFECTS, COASTS, OFFSHORE DEVELOPMENT, RESOURCE MANAGEMENT, *CONFERENCES, *COASTAL IMPACTS,

1518 ENVIRONMENTAL EFFECTS, BLM, OFFSHORE DEVELOPMENT, OCS, HYDROCARBONS, *TRACE METALS,

1520 ENVIRONMENTAL EFFECTS, ALASKA, OFFSHORE DEVELOPMENT, OIL SPILLS, OCS, *GEOLOGY, *HYDROLOGY, *YUKON DELTA,

1521 ENVIRONMENTAL EFFECTS, DEVELOPMENT, OFFSHORE PRODUCTION, US, OIL SHALE,

1522 ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, OIL SPILLS, PIPELINES, MARSHES, LOUISIANA, *LAFOURCHE PARISH,

1523 ENVIRONMENTAL EFFECTS, BEAUFORT SEA, BASELINE STUDIES, ARCTIC, OFFSHORE DRILLING, SPILL CLEANUP, ICE, MARINE ORGANISMS,

1524 ENVIRONMENTAL EFFECTS, EIS, BLM, ATLANTIC OCEAN, ARGO MERCHANT SPILL, OIL-GAS LEASING, FISHERIES, *GEORGES BANK,

1525 ENVIRONMENTAL EFFECTS, SOCIO-ECONOMIC EFFECTS, OIL INDUSTRY, PRODUCTION, SCOTLAND, *SULLOM VOE,

1526 ENVIRONMENTAL EFFECTS, COASTS, OFFSHORE PRODUCTION, EXTRACTION, FATE, HYDROCARBONS, *PRODUCED WATERS,

1530 ENVIRONMENTAL EFFECTS, ONSHORE IMPACTS, OFFSHORE DRILLING,

1531 ENVIRONMENTAL EFFECTS, BIRDS, BEAUFORT SEA, OFFSHORE DRILLING, OIL SPILLS, SPREADING, MOVEMENT, MARINE MAMMALS, FISH,

1532 ENVIRONMENTAL EFFECTS, FOSSIL FUELS, WATER QUALITY, OIL SPILLS,

1533 ENVIRONMENTAL EFFECTS, BIRDS, BASELINE STUDIES, ALASKA, OFFSHORE DEVELOPMENT, OCS, MARINE ORGANISMS,

1534 ENVIRONMENTAL EFFECTS, BASELINE STUDIES, ALASKA, OFFSHORE DEVELOPMENT, OCS,

1537 ENVIRONMENTAL EFFECTS, ECONOMICS, DEVELOPMENT, OIL SHALE, PRODUCTION,

1538 ENVIRONMENTAL EFFECTS, DEVELOPMENT, OIL SHALE, *RESEARCH PROGRAMS,

1539 ENVIRONMENTAL EFFECTS, ATLANTIC COAST, OIL SPILLS, OFFSHORE DEVELOPMENT, OCS, *RISK ANALYSIS,

1543 ENVIRONMENTAL EFFECTS, ECONOMICS, DEVELOPMENT, OIL SHALE,

1580 ENVIRONMENTAL EFFECTS, COST ANALYSIS, MODELS, OIL SPILLS, NORTH SEA, *COMPUTER SIMULATION,

1587 ENVIRONMENTAL EFFECTS, DISPERSIONS, MODELS, FATE, OCEANS, SPILL CONTAINMENT, MARINE

ORGANISMS,
1626 ENVIRONMENTAL EFFECTS, BIBLIOGRAPHIES, PIPELINES, OIL TRANSPORT, OFFSHORE DEVELOPMENT,
1026 ENVIRONMENTAL PROTECTION, BALTIC SEA, UK, USSR, *JOINT UK/USSR COMMITTEE,
1048 ENVIRONMENTAL PROTECTION, MONITORING, OIL DISCHARGES, OIL INDUSTRY, GOVERNMENT AGENCIES,
1147 ENVIRONMENTAL PROTECTION, ECONOMICS, SPILL CLEANUP, OFFSHORE DEVELOPMENT, SAFETY, NORTH SEA, NORWAY,
1205 ENVIRONMENTAL PROTECTION, COST ANALYSIS, POLLUTION CONTROL, TANKERS, SEGREGATED BALLAST , REGULATIONS, USCG,
1470 ENVIRONMENTAL PROTECTION, DEVELOPMENT, COASTS, BIRDS, ALASKA, OIL FIELDS, PRUDHOE BAY, *TUNDRA WETLANDS,
1528 ENVIRONMENTAL PROTECTION, ECONOMICS, OFFSHORE PRODUCTION, SAFETY, POLLUTION PREVENTION,
1606 ENVIRONMENTAL PROTECTION, LEGISLATION, US, OFFSHORE DEVELOPMENT, OIL-GAS LEASING, ONSHORE IMPACTS, *OCS LANDS ACT AMENDMENTS,
1122 EPA, SPILL CLEANUP, US, STATISTICAL ANALYSIS, USCG, INFORMATION SYSTEMS,
1331 EPA, DRILLING, CONTINGENCY PLANNING, POLLUTION PREVENTION, OIL DISCHARGES, REGULATIONS, *NAVIGABLE WATERS,
1609 EPA, LEGISLATION, US, WATER QUALITY, PRODUCTION, *UNDERGROUND INJECTION,
1037 ESTUARIES, CONTAMINANTS, COASTS, MONITORING, *METHODS, *INDICATOR ORGANISMS,
1038 ESTUARIES, ENVIRONMENTAL EFFECTS, COASTS, BASELINE STUDIES, ALASKA, MONITORING, *STREAMFLOW, OFFSHORE DEVELOPMENT, OIL SPILLS,
1052 ESTUARIES, CONTAMINATION, MONITORING, METABOLISM, MOLLUSKS, HYDROCARBONS, *ADENYLATE ENERGY CHARGE, *ENVIRONMENTAL STRESS,
1078 ESTUARIES, DISPERSIONS, REMOTE SENSING, WASTEWATERS, OCS, *CURRENT CIRCULATION,
1085 ESTUARIES, ALABAMA, SAMPLING, HYDROCARBONS, SEDIMENTS, OCS, OIL SPILLS, TOXICITY, MISSISSIPPI,
1349 ESTUARIES, OIL SPILLS, DELAWARE RIVER, TOXICITY, FISH, *CORINTHOS SPILL,
1469 ESTUARIES, DISTRIBUTION, BIOLOGICAL EFFECTS, BEAUFORT SEA, BASELINE STUDIES, MONITORING, FISHERIES, OFFSHORE DEVELOPMENT,
1544 ESTUARIES, CRUDE OIL, BIODEGRADATION, MICROORGANISMS, MARSHES,
1565 ESTUARIES, BIODEGRADATION, BACTERIA, HYDROCARBONS, METABOLISM, *CYCLOHEXANE,
1568 ESTUARIES, CRUDE OIL, BIODEGRADATION, BACTERIA, MICROORGANISMS,
1631 ESTUARIES, CONTAMINATION, COASTS, BIBLIOGRAPHIES,
1616 EUROPE, INTERNATIONAL CONVENTIONS, POLLUTION CONTROL, REGULATIONS, LIABILITY, OFFSHORE DEVELOPMENT, NORTH SEA,
1223 EVAPORATION, OIL TRANSPORT, PIPELINES, OIL SPILLS, LEAKAGE, FATE, SPREADING, MODELS, *IGNITION HAZARDS,
1572 EVAPORATION, CRUDE OIL, OIL SPILLS, MODELS, SOLUTION, HYDROCARBONS, TOXICITY,
1582 EVAPORATION, DISPERSIONS, OFFSHORE DRILLING, OIL SPILLS, FATE, SPILL RECOVERY, NORTH SEA, *EKOFISK WELL BLOWOUT,
1095 EXTRACTION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, HYDROCARBONS, SOLVENTS, SPECTROMETRY,
1105 EXTRACTION, ANALYTICAL TECHNIQUES, PETROLEUM PRODUCTS, *GRAVIMETRIC DETERMINATION, SOLVENTS,
1109 EXTRACTION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, PAH, *FLUORESCENCE,
1526 EXTRACTION, ENVIRONMENTAL EFFECTS, COASTS, OFFSHORE PRODUCTION, FATE, HYDROCARBONS, *PRODUCED WATERS,
1527 EXTRACTION, EIS, DISPOSAL, COLORADO, OIL SHALE, SOLID WASTES, RESTORATION,
1031 FATE, CONTAMINANTS, BEAUFORT SEA, BASELINE STUDIES, MONITORING, *OCEAN CURRENTS, OCS, OFFSHORE DEVELOPMENT,
1059 FATE, CONTAMINANTS, COASTS, BASELINE STUDIES, ALASKA, MONITORING, *WIND CONDITIONS, OFFSHORE DEVELOPMENT,
1060 FATE, CONTAMINANTS, BASELINE STUDIES, ALASKA/GULF OF, MONITORING, *OCEAN CURRENTS, OFFSHORE DEVELOPMENT,
1062 FATE, DISTRIBUTION, BASELINE STUDIES, ALASKA, MONITORING, HYDROCARBONS, OCS,
1072 FATE, ENVIRONMENTAL EFFECTS, CONTINGENCY PLANNING, ALASKA, REMOTE SENSING, OCS, OFFSHORE DEVELOPMENT, OIL SPILLS,
1063 FATE, SAMPLING, HYDROCARBONS, OCEANS,
1203 FATE, BIOLOGICAL EFFECTS, OIL TRANSPORT, OIL DISCHARGES, SOURCES, MARINE ORGANISMS, FISHERIES, PACIFIC OCEAN,
1223 FATE, EVAPORATION, OIL TRANSPORT, PIPELINES, OIL SPILLS, LEAKAGE, SPREADING, MODELS, *IGNITION HAZARDS,
1329 FATE, ENVIRONMENTAL EFFECTS, CRUDE OIL, POLLUTION PREVENTION, OFFSHORE DRILLING, OIL TRANSPORT, SPILL CLEANUP, NORTH SEA,
1438 FATE, DRIFT, OIL SLICKS, OCEANS, *WAVE DAMPING, *WIND WAVE TUNNEL,
1444 FATE, BIOLOGICAL EFFECTS, ATLANTIC OCEAN, ARGO MERCHANT SPILL, MARINE ORGANISMS,
1449 FATE, DISPERSANTS, CONTAMINATION, BIOLOGICAL EFFECTS, OIL DISCHARGES, SHIPS, TANKERS,
1459 FATE, ENVIRONMENTAL EFFECTS, CONTAMINANTS, BIOLOGICAL EFFECTS, REGULATIONS, *BOOK REVIEW,
1526 FATE, EXTRACTION, ENVIRONMENTAL EFFECTS, COASTS, OFFSHORE PRODUCTION, HYDROCARBONS, *PRODUCED WATERS,
1540 FATE, OIL WELLS, *SUBMARINE BLOWOUT SIMULATION, MODELS, CONTAINMENT,
1562 FATE, EMULSIFICATION, DISPERSIONS, BIODEGRADATION, BACTERIA, OIL SPILLS, WEATHERING,
1579 FATE, CONTAMINATION, BIOLOGICAL EFFECTS, ATLANTIC OCEAN, ARGO MERCHANT SPILL, FUEL OIL, MARINE ORGANISMS, NOAA,
1581 FATE, CONTAMINATION, ATLANTIC OCEAN, ARGO MERCHANT SPILL, FUEL OIL, MARINE ORGANISMS,

FISHERIES, MODELS, MOVEMENT, NOAA,
1582 FATE, EVAPORATION, DISPERSIONS, OFFSHORE DRILLING, OIL SPILLS, SPILL RECOVERY, NORTH SEA, *EKOFISK WELL BLOWOUT,
1583 FATE, OIL SPILLS, MOVEMENT, MODELS, *GULF STREAM,
1584 FATE, DISTRIBUTION, BIOLOGICAL EFFECTS, OIL SPILLS, HYDROCARBONS, MARSHES, METABOLISM, MARINE ORGANISMS, MASSACHUSETTS,
1585 FATE, CONTAMINANTS, MODELS, MOVEMENT, OFFSHORE DRILLING, PRUDHOE BAY, *OCEAN CIRCULATION, *POLLUTANT TRANSPORT,
1587 FATE, ENVIRONMENTAL EFFECTS, DISPERSIONS, MODELS, OCEANS, SPILL CONTAINMENT, MARINE ORGANISMS,
1590 FATE, BASELINE STUDIES, ALASKA, MODELS, *CIRCULATION, OCS, OIL SPILLS, *TRAJECTORY ANALYSIS,
1591 FATE, BASELINE STUDIES, ALASKA/GULF OF, OFFSHORE DEVELOPMENT, OIL SPILLS, OCS, *OCEAN CIRCULATION, *FLOW TRAJECTORIES,
1595 FATE, CHRONIC EFFECTS, BIOLOGICAL EFFECTS, ACUTE EFFECTS, OIL DISCHARGES, MARINE ORGANISMS, NORTH SEA,
1596 FATE, EIS, ATLANTIC COAST, OIL TRANSPORT, OCS, *SUSPENDED MATTER,
1597 FATE, CONTAMINANTS, BASELINE STUDIES, ALASKA, *OCEAN CIRCULATION, OCS, OFFSHORE DEVELOPMENT,
1599 FATE, MODELS, OIL SPILLS, OCEANS, *COMPUTER PROGRAMMING,
1633 FATE, BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, OIL SPILLS, MARINE ORGANISMS, SPILL CLEANUP,
1217 FEA, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, CRUDE OIL, STORAGE, *STRATEGIC PETROLEUM RESERVE,
1234 FILTRATION, EMULSIONS, WASTE OIL DISPOSAL, OIL-WATER SEPARATION,
1239 FILTRATION, EMULSIONS, ECONOMICS, WASTEWATER TREATMENT, *ULTRAFILTRATION MEMBRANE,
1243 FILTRATION, DESIGN-ENGINEERING, COALESCENCE, WASTEWATER TREATMENT, PETROLEUM PRODUCTS, PATENT,
1256 FILTRATION, DESIGN-ENGINEERING, OIL-WATER SEPARATION, PATENT,
1260 FILTRATION, EMULSIONS, OIL-WATER SEPARATION, COAGULATION, PATENT,
1264 FILTRATION, BILGES, WASTEWATER TREATMENT, OIL-WATER SEPARATION, *TUBULAR ULTRAFILTRATION SYSTEM,
1266 FILTRATION, EMULSIONS, DESIGN-ENGINEERING, WASTEWATER TREATMENT, PH CONTROL, PATENT,
1269 FILTRATION, EMULSIONS, COALESCENCE, OIL-WATER SEPARATION, PATENT,
1281 FILTRATION, EMULSIONS, COALESCENCE, OIL-WATER SEPARATION, FLOTATION, PATENT, *MAGNETIC POWDER,
1284 FILTRATION, ADSORPTION, WASTEWATER TREATMENT, PETROCHEMICALS,
1285 FILTRATION, WASTEWATER TREATMENT, *POLYURETHANE FOAM,
1307 FILTRATION, ABSORPTION, WASTEWATER TREATMENT, *POWDERED STEEL-MELTING SLAG,
1313 FILTRATION, WASTE OIL, LUBRICATING OIL, RECLAMATION, PATENT,
1056 FISH, CRUDE OIL, CHROMATOGRAPHY, CHEMICAL ANALYSIS, MONITORING, *EELS, *BIO-INDICATORS,
1088 FISH, CHEMICAL ANALYSIS, BEAUFORT SEA, SAMPLING, HYDROCARBONS, SEAWATER, PLANKTON, SEDIMENTS, SOURCES,
1349 FISH, ESTUARIES, OIL SPILLS, DELAWARE RIVER, TOXICITY, *CORINTHOS SPILL,
1361 FISH, BLACK SEA, BENTHOS, PETROLEUM PRODUCTS, TOXICITY, MARINE ORGANISMS, *SHRIMP, *ELECTRICAL CURRENTS,
1362 FISH, PETROLEUM PRODUCTS, PAH, UPTAKE, RELEASE, *3,4-BENZOPYRENE,
1370 FISH, CHRONIC EFFECTS, BERING SEA, ALASKA, ACUTE EFFECTS, HYDROCARBONS, TOXICITY,
1377 FISH, CRUSTACEANS, HYDROCARBONS, UPTAKE, RELEASE, METABOLISM, *LABELED N-ALKANES,
1395 FISH, CRUDE OIL, ALASKA, TOXICITY, *LIVER AND SKIN TISSUES,
1396 FISH, CRUSTACEANS, BIOLOGICAL EFFECTS, ALASKA, HYDROCARBONS, UPTAKE, RELEASE, *BIOTRANSFORMATION,
1397 FISH, TOXICITY, PETROLEUM PRODUCTS, METABOLISM, INVERTEBRATES,
1398 FISH, ACUTE EFFECTS, TOXICITY, WASTEWATERS, REFINERIES, FRESHWATER, *REDEAR SUNFISH,
1399 FISH, ACUTE EFFECTS, HYDROCARBONS, TOXICITY, *FATHEAD MINNOWS,
1413 FISH, TOXICITY, PETROLEUM PRODUCTS, PETROCHEMICALS,
1415 FISH, CRUDE OIL, ALASKA, FUEL OIL, HYDROCARBONS, *RESPIRATION RATE, *ONCORHYNCHUS GORBUSCHA,
1419 FISH, CRUDE OIL, ALASKA/GULF OF, ACUTE EFFECTS, TOXICITY, FISHERIES, OFFSHORE DEVELOPMENT, *PACIFIC HERRING,
1431 FISH, CONTAMINATION, *TEMPERATURE EFFECTS, *STURGEONS,
1433 FISH, DISPERSANTS, ACUTE EFFECTS, TOXICITY, SOLVENTS, *FISH LARVAE,
1455 FISH, UPTAKE, RELEASE, HYDROCARBONS, *BENZENE, *NORTHERN ANCHOVY, *STRIPED BASS,
1492 FISH, BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT, OCS, FISHERIES, HABITAT, *PACIFIC HERRING,
1497 FISH, ENVIRONMENTAL EFFECTS, BERING SEA, BEAUFORT SEA, BASELINE STUDIES, ALASKA/GULF OF, MONITORING, OFFSHORE DEVELOPMENT, OCS, *FISH DISEASES,
1499 FISH, BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA/GULF OF, FISHERIES, *SHELLFISH, OFFSHORE DEVELOPMENT, *DEMERSAL RESOURCES,
1503 FISH, BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, ALASKA/GULF OF, FOOD WEB, OFFSHORE DEVELOPMENT,
1504 FISH, DRILLING, ARCTIC, ACUTE EFFECTS, OIL WELLS, TOXICITY, *TROUT, *DRILLING MUDS,
1506 FISH, ENVIRONMENTAL EFFECTS, DRILLING, OIL WELLS, TOXICITY, *SALMON, *DRILLING MUDS,
1531 FISH, ENVIRONMENTAL EFFECTS, BIRDS, BEAUFORT SEA, OFFSHORE DRILLING, OIL SPILLS, SPREADING, MOVEMENT, MARINE MAMMALS,
1630 FISH, DISTRIBUTION, BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, BEAUFORT SEA, OFFSHORE DEVELOPMENT,

1632 FISH, BIBLIOGRAPHIES, BERING SEA, BASELINE STUDIES, ALASKA/GULF OF, *NON-SALMONID PELAGIC FISHES,
1013 FISHERIES, ENVIRONMENTAL EFFECTS, ARGO MERCHANT SPILL, OLYMPIC GAMES SPILL,
1022 FISHERIES, ENVIRONMENTAL EFFECTS, ARGO MERCHANT SPILL, TANKERS, SPILL CLEANUP, LIABILITY,
1024 FISHERIES, CONTAMINATION, OIL SPILLS, FUEL OIL, MASSACHUSETTS, *BUZZARDS BAY, *SHELLFISH RESOURCES,
1027 FISHERIES, ARGO MERCHANT SPILL, TANKERS, LEGISLATION, USCG, *NEW ENGLAND,
1203 FISHERIES, FATE, BIOLOGICAL EFFECTS, OIL TRANSPORT, OIL DISCHARGES, SOURCES, MARINE ORGANISMS, PACIFIC OCEAN,
1360 FISHERIES, BIRDS, BIOLOGICAL EFFECTS, ALGAE, METULA SPILL, MOLLUSKS, MAGELLAN/STRAIT OF,
1419 FISHERIES, FISH, CRUDE OIL, ALASKA/GULF OF, ACUTE EFFECTS, TOXICITY, OFFSHORE DEVELOPMENT, *PACIFIC HERRING,
1428 FISHERIES, CONTAMINATION, CHRONIC EFFECTS, JAPAN, *TOKYO BAY, *SETO INLAND SEA,
1462 FISHERIES, ENVIRONMENTAL EFFECTS, CHINA, OIL SPILLS, PLANKTON, MONITORING, *HONG KONG,
1469 FISHERIES, ESTUARIES, DISTRIBUTION, BIOLOGICAL EFFECTS, BEAUFORT SEA, BASELINE STUDIES, MONITORING, OFFSHORE DEVELOPMENT,
1492 FISHERIES, FISH, BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT, OCS, HABITAT, *PACIFIC HERRING,
1499 FISHERIES, FISH, BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA/GULF OF, *SHELLFISH, OFFSHORE DEVELOPMENT, *DEMERSAL RESOURCES,
1508 FISHERIES, ECONOMIC EFFECTS, CONTAMINATION, OFFSHORE DEVELOPMENT, FRANCE,
1524 FISHERIES, ENVIRONMENTAL EFFECTS, EIS, BLM, ATLANTIC OCEAN, ARGO MERCHANT SPILL, OIL-GAS LEASING, *GEORGES BANK,
1581 FISHERIES, FATE, CONTAMINATION, ATLANTIC OCEAN, ARGO MERCHANT SPILL, FUEL OIL, MARINE ORGANISMS, MODELS, MOVEMENT, NOAA,
1593 FISHERIES, CONTAMINATION, BERING SEA, *CIRCULATION, OFFSHORE DEVELOPMENT, FOOD WEB, *BRISTOL BAY,
1251 FLOCCULATION, COALESCENCE, WASTEWATER TREATMENT, REFINERIES, OIL-WATER SEPARATION, FLOTATION, *OZONATION,
1263 FLOCCULATION, DRILLING, BIODEGRADATION, BACTERIA, OIL WELLS, WASTEWATER TREATMENT, PATENT,
1277 FLOCCULATION, WASTEWATER TREATMENT, FUEL OIL, HYDROCARBONS, PH CONTROL, PATENT,
1319 FLOCCULATION, WASTE OIL TREATMENT, LUBRICATING OIL, RECLAMATION, SURFACTANTS, PRECIPITATION, PATENT,
1578 FLOCCULATION, HYDROCARBONS, SEDIMENTATION, RIVERS, FRANCE, *GULF OF LION,
1102 FLORIDA, COASTS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, BIODEGRADATION, BACTERIA, HYDROCARBONS, SEDIMENTS, PETROLEUM PRODUCTS,
1466 FLORIDA COAST, CONTAMINATION, WATER QUALITY, *HUMAN IMPACT, *BISCAYNE BAY,
1236 FLOTATION, PETROCHEMICALS, WASTEWATER TREATMENT, PH CONTROL, OXIDATION, COAGULATION,
1251 FLOTATION, FLOCCULATION, COALESCENCE, WASTEWATER TREATMENT, REFINERIES, OIL-WATER SEPARATION, *OZONATION,
1253 FLOTATION, DESIGN-ENGINEERING, OIL-WATER SEPARATION, *AERATION, *WEMCO HYDROCLEANER,
1258 FLOTATION, EMULSIONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, *AERATION, PATENT,
1267 FLOTATION, WASTEWATER TREATMENT, OIL-WATER SEPARATION, PATENT, *POWDERED MICA,
1281 FLOTATION, FILTRATION, EMULSIONS, COALESCENCE, OIL-WATER SEPARATION, PATENT, *MAGNETIC POWDER,
1287 FLOTATION, EMULSIONS, WASTEWATER TREATMENT, SLUDGE, PH CONTROL, COAGULATION, *AERATION,
1299 FLOTATION, EMULSIONS, WASTEWATER TREATMENT, REFINERIES, OIL-WATER SEPARATION, SKIMMERS,
1306 FLOTATION, EMULSIONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, PH CONTROL, PATENT,
1350 FOOD WEB, BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA/GULF OF, OFFSHORE DEVELOPMENT, OIL SPILLS, *PRIMARY PRODUCTION,
1406 FOOD WEB, CONTAMINATION, BIOLOGICAL EFFECTS, OCEANS, PETROLEUM PRODUCTS, PHYTOPLANKTON,
1408 FOOD WEB, BIOLOGICAL EFFECTS, HYDROCARBONS, PLANTS, *PHOTOSYNTHESIS, *ZOSTERA MARINA,
1467 FOOD WEB, BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, MONITORING, PHYTOPLANKTON, ICE, OFFSHORE DEVELOPMENT,
1476 FOOD WEB, BIOLOGICAL EFFECTS, BENTHOS, BEAUFORT SEA, OFFSHORE DRILLING, OIL SPILLS,
1500 FOOD WEB, CONTAMINANTS, BIOLOGICAL EFFECTS, ALASKA/GULF OF, OFFSHORE DEVELOPMENT, MARINE MAMMALS, *ECOLOGY, *HARBOR SEAL,
1503 FOOD WEB, FISH, BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, ALASKA/GULF OF, OFFSHORE DEVELOPMENT,
1593 FOOD WEB, FISHERIES, CONTAMINATION, BERING SEA, *CIRCULATION, OFFSHORE DEVELOPMENT, *BRISTOL BAY,
1611 FOREIGN GOVERNMENTS, LEGISLATION, US, OIL DISCHARGES, POLLUTION PREVENTION, LIABILITY,
1325 FRANCE, CRUDE OIL, POLLUTION PREVENTION, SPILL CLEANUP, *POLMAR PLAN,
1392 FRANCE, ENVIRONMENTAL EFFECTS, BIODEGRADATION, BACTERIA, REFINERIES, WASTEWATERS, MARINE ORGANISMS, PHYTOPLANKTON,
1508 FRANCE, FISHERIES, ECONOMIC EFFECTS, CONTAMINATION, OFFSHORE DEVELOPMENT,
1578 FRANCE, FLOCCULATION, HYDROCARBONS, SEDIMENTATION, RIVERS, *GULF OF LION,
1613 FRANCE, LEGISLATION, POLLUTION PREVENTION, TANKERS, *FRENCH MARITIME LAW, *OLYMPIC BRAVERY SPILL,
1188 FRESHWATER, CRUDE OIL, ARCTIC, SPILL RECOVERY, SKIMMERS, ICE, *LOCKHEED CLEAN SWEEP,
1398 FRESHWATER, FISH, ACUTE EFFECTS, TOXICITY, WASTEWATERS, REFINERIES, *REDEAR SUNFISH,

1023 FUEL OIL, ENVIRONMENTAL EFFECTS, OIL SPILLS, SPILL CLEANUP, MOVEMENT, JAPAN, *INLAND SEA,
1024 FUEL OIL, FISHERIES, CONTAMINATION, OIL SPILLS, MASSACHUSETTS, *BUZZARDS BAY, *SHELLFISH RESOURCES,
1065 FUEL OIL, DETECTION, DESIGN-ENGINEERING, BILGES, MONITORING, SHIPS, *OIL-IN-WATER DETECTOR,
1068 FUEL OIL, DETECTION, DESIGN-ENGINEERING, CRUDE OIL, CONTAMINANTS, MONITORING, PATENT, *OPTICAL SENSOR,
1225 FUEL OIL, CRUDE OIL, ALASKA, SPILL DISPOSAL, STORAGE,
1277 FUEL OIL, FLOCCULATION, WASTEWATER TREATMENT, HYDROCARBONS, PH CONTROL, PATENT,
1314 FUEL OIL, WASTEWATER TREATMENT, WASTE OIL, RECLAMATION, REUSE, *MEMBRANE TECHNIQUES,
1351 FUEL OIL, DISPERSIONS, CRUDE OIL, TOXICITY, MOLLUSKS, *OYSTER, *CRASSOSTREA, VIRGINICA,
1354 FUEL OIL, OIL SPILLS, TOXICITY, MICROORGANISMS, YEASTS, *ULTRAVIOLET LIGHT EXPOSURE,
1363 FUEL OIL, CORALS, BIOLOGICAL EFFECTS, MARINE ORGANISMS, TROPICAL REGIONS, INTERTIDAL ZONE,
1366 FUEL OIL, CRUDE OIL, TOXICITY, MOLLUSKS, WASTE OIL, *CLAMS, *MERCENARIA,
1375 FUEL OIL, CONTAMINANTS, HYDROCARBONS, TOXICITY, *FUEL ADDITIVES,
1381 FUEL OIL, BIRDS, BIOLOGICAL EFFECTS, *YOLK STRUCTURE, *EGG HATCHABILITY,
1385 FUEL OIL, CRUDE OIL, COASTS, CANADA, BACTERIA, TOXICITY, *GLUCOSE UPTAKE,
1390 FUEL OIL, BEHAVIOR, ACUTE EFFECTS, TOXICITY, ZOOPLANKTON, *WATER SOLUBLE FRACTIONS,
1391 FUEL OIL, CRUSTACEANS, CRUDE OIL, TOXICITY, *AMPHIPODS,
1403 FUEL OIL, ECHINODERMS, CRUDE OIL, TOXICITY, MARINE ORGANISMS, *SAND DOLLARS,
1415 FUEL OIL, FISH, CRUDE OIL, ALASKA, HYDROCARBONS, *RESPIRATION RATE, *ONCORHYNCHUS GORBUSCHA,
1416 FUEL OIL, AROMATIC HYDROCARBONS, POLYCHAETES, UPTAKE, RELEASE, *NAPHTHALENE, *NEANTHES ARENACEODENTATA,
1422 FUEL OIL, BIOLOGICAL EFFECTS, MOLLUSKS, *CLAMS, *MYA ARENARIA,
1423 FUEL OIL, CRUDE OIL, TOXICITY, MOLLUSKS, METABOLISM, *CLAMS, *MYA ARENARIA,
1424 FUEL OIL, CHRONIC EFFECTS, ACUTE EFFECTS, OIL SPILLS, TOXICITY, MOLLUSKS, INTERTIDAL ZONE, *HONG KONG,
1430 FUEL OIL, EMULSIONS, DISPERSANTS, CRUDE OIL, TOXICITY, MOLLUSKS, UK,
1434 FUEL OIL, ALGAE, TOXICITY, *GROWTH RATES, *PHENALEN-1-ONE,
1579 FUEL OIL, FATE, CONTAMINATION, BIOLOGICAL EFFECTS, ATLANTIC OCEAN, ARGO MERCHANT SPILL, MARINE ORGANISMS, NOAA,
1581 FUEL OIL, FISHERIES, FATE, CONTAMINATION, ATLANTIC OCEAN, ARGO MERCHANT SPILL, MARINE ORGANISMS, MODELS, MOVEMENT, NOAA,
1148 FUELS, DESIGN-ENGINEERING, SPILL RECOVERY, WASTE OIL, OIL-WATER SEPARATION, SKIMMERS,
1252 FUELS, EMULSIONS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, PATENT,
1338 FUELS, REFINERIES, PETROCHEMICALS, POLLUTION PREVENTION, WASTEWATER TREATMENT,
1532 FUELS, FOSSIL, ENVIRONMENTAL EFFECTS, WATER QUALITY,
1557 FUELS, BIODEGRADATION, PETROLEUM PRODUCTS, MICROORGANISMS,
1394 FUNGI, CRUDE OIL, BIOLOGICAL EFFECTS, BIODEGRADATION, WASTE OIL, SOIL,
1116 GERMANY, EAST, CONTAMINANTS, COASTS, ANALYTICAL TECHNIQUES, HYDROCARBONS, *SPECTROPHOTOMETRY, *COLORIMETRY,
1297 GERMANY, WEST, REFINERIES, WASTEWATER TREATMENT, RECYCLING, OIL-WATER SEPARATION, SLUDGE,
1048 GOVERNMENT AGENCIES, ENVIRONMENTAL PROTECTION, MONITORING, OIL DISCHARGES, OIL INDUSTRY,
1317 GOVERNMENT AGENCIES, WASTE OIL, REFINING, LUBRICATING OIL, RECLAMATION, REUSE,
1323 GOVERNMENT AGENCIES, CONTINGENCY PLANNING, SPILL CLEANUP, INDUSTRIES, *OIL SPILL COOPERATIVES,
1041 GROUNDWATER, DESIGN-ENGINEERING, CONTAMINATION, MONITORING, SPILL CLEANUP,
1441 GROUNDWATER, CONTAMINATION, CHEMICAL ANALYSIS, PETROLEUM PRODUCTS, OIL TANKS, USSR,
1516 GROUNDWATER, ENVIRONMENTAL EFFECTS, PRODUCTION, *TERTIARY OIL RECOVERY METHODS, WATER QUALITY, MODELS,
1571 GROUNDWATER, CONTAMINATION, CALIFORNIA, WASTEWATER DISPOSAL, SPREADING,
1620 GUIDELINES, CRUDE OIL, PETROLEUM PRODUCTS, OIL TRANSFER, TANKERS, SAFETY, *TERMINALS,
1621 GUIDELINES, CANADA, POLLUTION CONTROL, REFINERIES, WASTEWATERS, REGULATIONS, MONITORING,
1623 GUIDELINES, OIL INDUSTRY, STORAGE, HEALTH HAZARDS, SAFETY, *BULK PETROLEUM PLANTS,
1387 HABITAT, BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA/GULF OF, OIL SPILLS, OCS, MOLLUSKS, OFFSHORE DEVELOPMENT, *CLAMS,
1471 HABITAT, COASTS, BIOLOGICAL EFFECTS, BEAUFORT SEA, BASELINE STUDIES, MONITORING, MARINE ORGANISMS, OFFSHORE DEVELOPMENT,
1474 HABITAT, DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BEAUFORT SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT, MARINE MAMMALS, ICE,
1492 HABITAT, FISHERIES, FISH, BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT, OCS, *PACIFIC HERRING,
1502 HABITAT, DISTRIBUTION, CONTAMINATION, ALASKA, MARINE MAMMALS, OFFSHORE DEVELOPMENT, *SEA OTTERS,
1542 HABITAT, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, ONSHORE IMPACTS, SPILL CLEANUP, POLLUTION PREVENTION,
1201 HARBORS, OIL DISCHARGES, OCEANS, SHIPS, *MERCHANT SHIPS,
1339 HARBORS, LEGISLATION, POLLUTION CONTROL, LAW ENFORCEMENT, TANKERS, WATER QUALITY, NETHERLANDS,

1346 HARBORS, OIL SPILLS, POLLUTION CONTROL, SHIPS, LAW ENFORCEMENT, UK, *MILFORD HAVEN,
1615 HARBORS, COMPENSATION, COASTS, INTERNATIONAL CONVENTIONS, POLLUTION PREVENTION, SHIPS, LIABILITY, IMCO,
1006 HEALTH HAZARDS, ECONOMICS, DISPOSAL, WASTE OIL, UK,
1086 HEALTH HAZARDS, SAMPLING, SOIL, REFINERIES, PETROCHEMICALS, PAH, *AGRICULTURE, POLAND,
1332 HEALTH HAZARDS, OFFSHORE DRILLING, OIL TRANSPORT, POLLUTION PREVENTION, OIL WELLS, SAFETY, OCS,
1623 HEALTH HAZARDS, GUIDELINES, OIL INDUSTRY, STORAGE, SAFETY, *BULK PETROLEUM PLANTS,
1016 HYDROCARBONS, CONTAMINATION, SOURCES, WASTEWATERS, ITALY, *GULF OF TRIESTE,
1034 HYDROCARBONS, CONTAMINANTS, COASTS, BASELINE STUDIES, MONITORING, MEDITERRANEAN SEA, *POLLUTANT TRANSPORT,
1039 HYDROCARBONS, BALLAST, MONITORING, PETROLEUM PRODUCTS, WASTEWATERS, PATENT, *SOUND VELOCITY CHARACTERISTICS,
1040 HYDROCARBONS, DISTRIBUTION, BERING SEA, BASELINE STUDIES, MONITORING, OCS, OFFSHORE DEVELOPMENT, *NATURALLY-OCCURRING HYDROCARBONS,
1051 HYDROCARBONS, CRUSTACEANS, MONITORING, SEAWATER, *MOTOR BEHAVIOR,
1052 HYDROCARBONS, ESTUARIES, CONTAMINATION, MONITORING, METABOLISM, MOLLUSKS, *ADENYLATE ENERGY CHARGE, *ENVIRONMENTAL STRESS,
1054 HYDROCARBONS, ANALYTICAL TECHNIQUES, MONITORING, MARINE ORGANISMS, UPTAKE, METABOLISM,
1058 HYDROCARBONS, MONITORING, MOLLUSKS, UPTAKE, RELEASE, METABOLISM, MANUALS,
1062 HYDROCARBONS, FATE, DISTRIBUTION, BASELINE STUDIES, ALASKA, MONITORING, OCS,
1083 HYDROCARBONS, FATE, SAMPLING, OCEANS,
1084 HYDROCARBONS, CONTAMINATION, BEACHES, SAMPLING, REFINERIES, SEDIMENTS,
1085 HYDROCARBONS, ESTUARIES, ALABAMA, SAMPLING, SEDIMENTS, OCS, OIL SPILLS, TOXICITY, MISSISSIPPI,
1088 HYDROCARBONS, FISH, CHEMICAL ANALYSIS, BEAUFORT SEA, SAMPLING, SEAWATER, PLANKTON, SEDIMENTS, SOURCES,
1092 HYDROCARBONS, CHEMICAL ANALYSIS, SAMPLING, REFINERIES, PETROCHEMICALS, SOURCES, MEXICO/GULF OF, *MISSISSIPPI DELTA,
1093 HYDROCARBONS, CHEMICAL ANALYSIS, OIL SLICKS, SWEDEN,
1094 HYDROCARBONS, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, MARINE ORGANISMS, SEDIMENTS, SPECTROSCOPY, PUGET SOUND, WASHINGTON,
1095 HYDROCARBONS, EXTRACTION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SOLVENTS, SPECTROMETRY,
1099 HYDROCARBONS, DISTRIBUTION, CHEMICAL ANALYSIS, BENTHOS, OCS, TEXAS, MEXICO/GULF OF,
1100 HYDROCARBONS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, MOLLUSKS, MARINE ORGANISMS, *SOXHLET EXTRACTION, *SAPONIFICATION,
1101 HYDROCARBONS, CONTAMINANTS, AROMATIC HYDROCARBONS, ANALYTICAL TECHNIQUES, *WATER POLLUTANTS,
1102 HYDROCARBONS, FLORIDA, COASTS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, BIODEGRADATION, BACTERIA, SEDIMENTS, PETROLEUM PRODUCTS,
1104 HYDROCARBONS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, WASTEWATERS, *GASOLINE FRACTIONS,
1106 HYDROCARBONS, DECOMPOSITION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, ACTIVATED SLUDGE,
1110 HYDROCARBONS, DESIGN-ENGINEERING, CHROMATOGRAPHY, CHEMICAL ANALYSIS, *HYDROCARBON MEASUREMENTS,
1114 HYDROCARBONS, WASTEWATERS, *SPECTRAL ABSORPTION CHARACTERISTICS, *HYDROCARBON CONCENTRATION,
1116 HYDROCARBONS, GERMANY, EAST, CONTAMINANTS, COASTS, ANALYTICAL TECHNIQUES, *SPECTROPHOTOMETRY, *COLORIMETRY,
1118 HYDROCARBONS, DETECTION, CRANKCASE OIL, CHEMICAL ANALYSIS, WASTEWATERS, MARINE ORGANISMS, NEW YORK,
1120 HYDROCARBONS, DISPERSIONS, DESIGN-ENGINEERING, *PETROLEUM BIOASSAY, *CONTINUOUS FLOW SYSTEM,
1123 HYDROCARBONS, CRUDE OIL, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION,
1131 HYDROCARBONS, CRUDE OIL, SOURCE IDENTIFICATION, PAH, SEDIMENTS, SOIL, PETROLEUM PRODUCTS,
1138 HYDROCARBONS, DESIGN-ENGINEERING, BOOMS, ABSORPTION, SPILL CONTAINMENT, PATENT,
1139 HYDROCARBONS, DESIGN-ENGINEERING, BOOMS, ADSORPTION, SPILL CONTAINMENT, PATENT,
1275 HYDROCARBONS, DISPERSIONS, COALESCENCE, OIL-WATER SEPARATION, PATENT,
1277 HYDROCARBONS, FUEL OIL, FLOCCULATION, WASTEWATER TREATMENT, PH CONTROL, PATENT,
1286 HYDROCARBONS, CHEMICAL ANALYSIS, WASTEWATER TREATMENT, OXIDATION, TOXICITY, *AERATION,
1352 HYDROCARBONS, CHRONIC EFFECTS, NATURAL SEEPAGE, MARINE ORGANISMS, SANTA BARBARA CHANNEL,
1370 HYDROCARBONS, FISH, CHRONIC EFFECTS, BERING SEA, ALASKA, ACUTE EFFECTS, TOXICITY,
1373 HYDROCARBONS, ACUTE EFFECTS, MARINE MAMMALS, TOXICITY, *SEALS, *PHOCA VITULINA,
1374 HYDROCARBONS, BIOLOGICAL EFFECTS, *WATER SOLUBLE FRACTIONS,
1375 HYDROCARBONS, FUEL OIL, CONTAMINANTS, TOXICITY, *FUEL ADDITIVES,
1377 HYDROCARBONS, FISH, CRUSTACEANS, UPTAKE, RELEASE, METABOLISM, *LABELED N-ALKANES,
1396 HYDROCARBONS, FISH, CRUSTACEANS, BIOLOGICAL EFFECTS, ALASKA, UPTAKE, RELEASE, *BIOTRANSFORMATION,
1399 HYDROCARBONS, FISH, ACUTE EFFECTS, TOXICITY, *FATHEAD MINNOWS,
1408 HYDROCARBONS, FOOD WEB, BIOLOGICAL EFFECTS, PLANTS, *PHOTOSYNTHESIS, *ZOSTERA MARINA,
1415 HYDROCARBONS, FUEL OIL, FISH, CRUDE OIL, ALASKA, *RESPIRATION RATE, *ONCORHYNCHUS GORBUSCHA,
1417 HYDROCARBONS, BIOLOGICAL EFFECTS, ANALYTICAL TECHNIQUES, MARINE ORGANISMS, *SPIN-LABELING TECHNIQUES,

1418 HYDROCARBONS, BIOLOGICAL EFFECTS, LAKES, PHYTOPLANKTON, *OUTBOARD MARINE ENGINE EXHAUST,
1421 HYDROCARBONS, ECOSYSTEMS, COASTS, WASTEWATERS, INDUSTRIES, MARINE ORGANISMS,
1429 HYDROCARBONS, BIOLOGICAL EFFECTS, ALGAE, METABOLISM, *NAPHTHALENE,
1442 HYDROCARBONS, DISPERSANTS, CONTAMINATION, OIL INDUSTRY, *ACUATIC POLLUTION,
1452 HYDROCARBONS, ENVIRONMENTAL EFFECTS, ECOSYSTEMS, CONTAMINANTS, BALTIC SEA,
1455 HYDROCARBONS, FISH, UPTAKE, RELEASE, *BENZENE, *NORTHERN ANCHOVY, *STRIPED BASS,
1458 HYDROCARBONS, OCEANS, MARINE ORGANISMS,
1518 HYDROCARBONS, ENVIRONMENTAL EFFECTS, BLM, OFFSHORE DEVELOPMENT, OCS, *TRACE METALS,
1526 HYDROCARBONS, FATE, EXTRACTION, ENVIRONMENTAL EFFECTS, COASTS, OFFSHORE PRODUCTION, *PRODUCED WATERS,
1545 HYDROCARBONS, BIODEGRADATION, BEAUFORT SEA, BASELINE STUDIES, MICROORGANISMS, OFFSHORE DEVELOPMENT, OCS,
1546 HYDROCARBONS, BIODEGRADATION, BASELINE STUDIES, ALASKA/GULF OF, MICROORGANISMS, OFFSHORE DEVELOPMENT, OCS,
1548 HYDROCARBONS, BIODEGRADATION, BACTERIA, *LYSIS, *IONIC CONCENTRATION,
1549 HYDROCARBONS, BIODEGRADATION, BACTERIA, OXIDATION, TOXICITY, SURFACTANTS, *IONIC CONCENTRATION, *DETERGENTS,
1550 HYDROCARBONS, COASTS, BIODEGRADATION, BACTERIA, MONITORING,
1552 HYDROCARBONS, BIODEGRADATION, MICROORGANISMS, *AQUATIC ENVIRONMENT,
1554 HYDROCARBONS, CRUDE OIL, BIODEGRADATION, ATLANTIC OCEAN, MICROORGANISMS, SAMPLING,
1555 HYDROCARBONS, BIODEGRADATION, BACTERIA, NARRAGANSETT BAY, *GROWTH STUDIES,
1558 HYDROCARBONS, BIODEGRADATION, BACTERIA, METABOLISM,
1559 HYDROCARBONS, BIODEGRADATION, MICROORGANISMS, POLLUTION CONTROL,
1565 HYDROCARBONS, ESTUARIES, BIODEGRADATION, BACTERIA, METABOLISM, *CYCLOHEXANE,
1572 HYDROCARBONS, EVAPORATION, CRUDE OIL, OIL SPILLS, MODELS, SOLUTION, TOXICITY,
1577 HYDROCARBONS, DECOMPOSITION, OIL SLICKS, *PHOTOCHEMICAL DEGRADATION,
1578 HYDROCARBONS, FRANCE, FLOCCULATION, SEDIMENTATION, RIVERS, *GULF OF LION,
1584 HYDROCARBONS, FATE, DISTRIBUTION, BIOLOGICAL EFFECTS, OIL SPILLS, MARSHES, METABOLISM, MARINE ORGANISMS, MASSACHUSETTS,
1625 HYDROCARBONS, CHEMICAL ANALYSIS, BIBLIOGRAPHIES, OIL INDUSTRY, OIL SPILLS, SOURCE IDENTIFICATION, MARINE ORGANISMS,
1627 HYDROCARBONS, BIODEGRADATION, BIBLIOGRAPHIES, BACTERIA, ALGAE, OIL SPILLS, SPILL CLEANUP,
1142 ICE, CANADA, ARCTIC, OIL WELLS, *BLOWOUTS, SPILL DISPOSAL, INCINERATION,
1188 ICE, FRESHWATER, CRUDE OIL, ARCTIC, SPILL RECOVERY, SKIMMERS, *LOCKHEED CLEAN SWEEP,
1194 ICE, CANADA, BOOMS, SPILL CONTAINMENT, SPILL RECOVERY, RIVERS, *ST. CLAIR & DETROIT RIVERS,
1348 ICE, BEAUFORT SEA, ALGAE, PHYTOPLANKTON, *PRIMARY PRODUCTIVITY, *OIL-UNDER-ICE,
1467 ICE, FOOD WEB, BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, MONITORING, PHYTOPLANKTON, OFFSHORE DEVELOPMENT,
1474 ICE, HABITAT, DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BEAUFORT SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT, MARINE MAMMALS,
1523 ICE, ENVIRONMENTAL EFFECTS, BEAUFORT SEA, BASELINE STUDIES, ARCTIC, OFFSHORE DRILLING, SPILL CLEANUP, MARINE ORGANISMS,
1569 ICE, CRUDE OIL, COALESCENCE, BEHAVIOR, SPREADING, EMUSIFICATION, RIVERS,
1573 ICE, BEHAVIOR, ARCTIC, ABSORPTION, OIL SPILLS, SPREADING, SOLUBILITY, CLEANUP,
1574 ICE, COASTS, ARCTIC OCEAN, ALASKA, OIL SPILLS, *OIL-ICE INTERACTION,
1575 ICE, CRUDE OIL, MOVEMENT,
1594 ICE, CRUDE OIL, ARCTIC, MONITORING, SPREADING, MOVEMENT, WEATHERING, SPILL CLEANUP,
1598 ICE, OIL SPILLS, SPREADING, *OIL TEMPERATURE, *ICE TEMPERATURE, *SPILLING RATE,
1624 ICE, BIODEGRADATION, BIBLIOGRAPHIES, ARCTIC, OIL SLICKS, CONTAINMENT, RECOVERY, OIL TRANSFER, STORAGE, SPILL DISPOSAL,
1221 IMCO, REGULATIONS, POLLUTION PREVENTION, SHIPS, MONITORING,
1330 IMCO, MONITORING, OIL DISCHARGES, TANKERS, POLLUTION CONTROL, REGULATIONS, *BAILEY MONITOR PROGRAM,
1615 IMCO, HARBORS, COMPENSATION, COASTS, INTERNATIONAL CONVENTIONS, POLLUTION PREVENTION, SHIPS, LIABILITY,
1617 IMCO, INTERNATIONAL CONVENTIONS, TANKERS, POLLUTION PREVENTION, OIL DISCHARGES, OIL-WATER SEPARATION, MONITORING,
1618 IMCO, INTERNATIONAL CONVENTIONS, POLLUTION PREVENTION, LEGISLATION,
1142 INCINERATION, ICE, CANADA, ARCTIC, OIL WELLS, *BLOWOUTS, SPILL DISPOSAL,
1240 INCINERATION, DISPOSAL, DESIGN-ENGINEERING, SLUDGE, REFINERIES, *FLUID BED INCINERATION,
1268 INCINERATION, WASTEWATER TREATMENT, SLUDGE, REFINERIES, USSR,
1276 INCINERATION, DISPOSAL, DESIGN-ENGINEERING, COST ANALYSIS, SLUDGE, SOLID WASTES,
1028 INDUSTRIES, ECONOMIC EFFECTS, CONTAMINATION, WASTEWATERS, REFINERIES, SOURCES, INFORMATION SYSTEMS,
1113 INDUSTRIES, ANALYTICAL TECHNIQUES, WASTE OIL, PETROCHEMICALS, *X-RAY FLUORESCENCE,
1249 INDUSTRIES, CONTAMINANTS, ABSORPTION, WASTEWATER TREATMENT, *PEAT MOSS,
1288 INDUSTRIES, DISPOSAL, WASTEWATERS, SOLID WASTES, OIL INDUSTRY,
1298 INDUSTRIES, WASTEWATER TREATMENT, POLLUTION CONTROL, REFINERIES, SPILL CLEANUP, PATENT,
1308 INDUSTRIES, DESIGN-ENGINEERING, RECLAMATION, WASTE OIL,
1323 INDUSTRIES, GOVERNMENT AGENCIES, CONTINGENCY PLANNIHG, SPILL CLEANUP, *OIL SPILL COOPERATIVES,

1421 INDUSTRIES, HYDROCARBONS, ECOSYSTEMS, COASTS, WASTEWATERS, MARINE ORGANISMS,
1511 INDUSTRIES, ENVIRONMENTAL EFFECTS, *ENERGY CONSERVATION, REFINERIES, *TECHNOLOGY INNOVATION,
1020 INFORMATION SYSTEMS, OIL SPILLS, MANUALS,
1028 INFORMATION SYSTEMS, INDUSTRIES, ECONOMIC EFFECTS, CONTAMINATION, WASTEWATERS, REFINERIES, SOURCES,
1122 INFORMATION SYSTEMS, EPA, SPILL CLEANUP, US, STATISTICAL ANALYSIS, USCG,
1347 INFORMATION SYSTEMS, DESIGN-ENGINEERING, OFFSHORE DEVELOPMENT, OIL SPILLS, REGULATIONS, SAFETY, *OCEAN TECHNOLOGY,
1235 INLAND, DESIGN-ENGINEERING, OIL-WATER SEPARATION, WASTEWATERS, SKIMMERS, *AFL INDUSTRIES,
1439 INSURANCE, *MARINE INDUSTRY, TANKERS, LIABILITY,
1529 INSURANCE, REGULATIONS, LIABILITY, SHIPS, PORTS, OFFSHORE DEVELOPMENT,
1607 INTERNATIONAL AGREEMENTS, LEGISLATION, US, OIL SPILLS, SHIPS, TANKERS, *LEGAL PROBLEMS,
1614 INTERNATIONAL CONVENTIONS, REGULATIONS, TANKERS, SEGREGATED BALLAST, POLLUTION CONTROL,
1615 INTERNATIONAL CONVENTIONS, IMCO, HARBORS, COMPENSATION, COASTS, POLLUTION PREVENTION, SHIPS, LIABILITY,
1616 INTERNATIONAL CONVENTIONS, EUROPE, POLLUTION CONTROL, REGULATIONS, LIABILITY, OFFSHORE DEVELOPMENT, NORTH SEA,
1617 INTERNATIONAL CONVENTIONS, IMCO, TANKERS, POLLUTION PREVENTION, OIL DISCHARGES, OIL-WATER SEPARATION, MONITORING,
1618 INTERNATIONAL CONVENTIONS, IMCO, POLLUTION PREVENTION, LEGISLATION,
1619 INTERNATIONAL CONVENTIONS, OIL DISCHARGES, SHIPS, POLLUTION CONTROL, LAW ENFORCEMENT, OIL-WATER SEPARATION,
1063 INTERTIDAL ZONE, CRUDE OIL, ALASKA, MONITORING, SEDIMENTS, UPTAKE, RELEASE, *PORT VALDEZ,
1363 INTERTIDAL ZONE, FUEL OIL, CORALS, BIOLOGICAL EFFECTS, MARINE ORGANISMS, TROPICAL REGIONS,
1424 INTERTIDAL ZONE, FUEL OIL, CHRONIC EFFECTS, ACUTE EFFECTS, OIL SPILLS, TOXICITY, MOLLUSKS, *HONG KONG,
1505 INTERTIDAL ZONE, DISTRIBUTION, COASTS, CHRONIC EFFECTS, BERING SEA, BASELINE STUDIES, ALASKA/GULF OF, ACUTE EFFECTS, MONITORING, MARINE ORGANISMS,
1397 INVERTEBRATES, FISH, TOXICITY, PETROLEUM PRODUCTS, METABOLISM,
1410 INVERTEBRATES, CRUDE OIL, BIOLOGICAL EFFECTS, BEHAVIOR, ARCTIC, MARINE ORGANISMS, METABOLISM,
1411 INVERTEBRATES, CRUDE OIL, ARCTIC, TOXICITY, *AMPHIPOD, *COELENTERATE,
1460 IRAQ, CONTAMINATION, RIVERS, WASTE OIL, TANKERS, OIL TRANSFER, *SHATT AL-ARAB,
1018 ISRAEL, CONTAMINATION, SPILL CLEANUP, OIL TRANSFER, OIL SPILLS, PORTS, SHORELINES, *EILAT OIL TERMINAL,
1129 ISRAEL, CRUDE OIL, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, SAMPLING, CHEMICAL ANALYSIS, WEATHERING, MEDITERRANEAN SEA,
1016 ITALY, HYDROCARBONS, CONTAMINATION, SOURCES, WASTEWATERS, *GULF OF TRIESTE,
1021 JAPAN, ENVIRONMENTAL DETERIORATION, STATISTICS, OIL SPILLS, *SETO INLAND SEA,
1023 JAPAN, FUEL OIL, ENVIRONMENTAL EFFECTS, OIL SPILLS, SPILL CLEANUP, MOVEMENT, *INLAND SEA,
1428 JAPAN, FISHERIES, CONTAMINATION, CHRONIC EFFECTS, *TOKYO PAY, *SETO INLAND SEA,
1211 KENTUCKY, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, WATER QUALITY, OIL SPILLS, *CENTRAL ROCK MINE,
1117 LAKES, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, PAH, SEDIMENTS, SPECTROMETRY,
1121 LAKES, CHROMATOGRAPHY, AROMATIC HYDROCARBONS, ANALYTICAL TECHNIQUES, SPECTROSCOPY, SEDIMENTS, *FLUORESCENCE,
1418 LAKES, HYDROCARBONS, BIOLOGICAL EFFECTS, PHYTOPLANKTON, *OUTBOARD MARINE ENGINE EXHAUST,
1339 LAW ENFORCEMENT, HARBORS, LEGISLATION, POLLUTION CONTROL, TANKERS, WATER QUALITY, NETHERLANDS,
1343 LAW ENFORCEMENT, POLLUTION PREVENTION, SPILL CLEANUP, SURVEILLANCE, SOURCE IDENTIFICATION, USCG,
1346 LAW ENFORCEMENT, HARBORS, OIL SPILLS, POLLUTION CONTROL, SHIPS, UK, *MILFORD HAVEN,
1619 LAW ENFORCEMENT, INTERNATIONAL CONVENTIONS, OIL DISCHARGES, SHIPS, POLLUTION CONTROL, OIL-WATER SEPARATION,
1044 LEAKAGE, DETECTION, MONITORING, PIPELINES, PATENT, *MOBILE RECEIVER,
1064 LEAKAGE, MONITORING, PIPELINES, OIL TRANSPORT, *PIPELINE LEAK DETECTORS,
1223 LEAKAGE, FATE, EVAPORATION, OIL TRANSPORT, PIPELINES, OIL SPILLS, SPREADING, MODELS, *IGNITION HAZARDS,
1326 LEAKAGE, SHIPS, POLLUTION PREVENTION, *STERN GEAR SYSTEM,
1334 LEAKAGE, DETECTION, PIPELINES, PATENT, *ACOUSTIC LEAK DETECTION,
1451 LEAKAGE, ENVIRONMENTAL EFFECTS, OIL TRANSFER, PORTS, POLLUTION PREVENTION, SPILL CLEANUP, UK, *MILFORD HAVEN,
1027 LEGISLATION, FISHERIES, ARGO MERCHANT SPILL, TANKERS, USCG, *NEW ENGLAND,
1200 LEGISLATION, OIL SPILLS, TANKERS, POLLUTION PREVENTION, US,
1202 LEGISLATION, OIL TRANSPORT, TANKERS, OIL SPILLS, PUGET SOUND, WASHINGTON,
1227 LEGISLATION, ENVIRONMENTAL EFFECTS, DEVELOPMENT, ALASKA, PIPELINES, OIL SPILLS, LIABILITY,
1324 LEGISLATION, DESIGN-ENGINEERING, CONTINGENCY PLANNING, OIL DISCHARGES, US, SPILL

CLEANUP, SURVEILLANCE,
1335 LEGISLATION, ENVIRONMENTAL EFFECTS, OIL INDUSTRY, UK, MONITORING, OIL SPILLS, WASTEWATERS,
1339 LEGISLATION, LAW ENFORCEMENT, HARBORS, POLLUTION CONTROL, TANKERS, WATER QUALITY, NETHERLANDS,
1519 LEGISLATION, CALIFORNIA COAST, OFFSHORE DEVELOPMENT, ONSHORE IMPACTS,
1601 LEGISLATION, COMPENSATION, REGULATIONS, SPILL CLEANUP, STATE GOVERNMENTS, OIL TRANSFER, NEW JERSEY,
1602 LEGISLATION, CALIFORNIA, OIL SPILLS, LIABILITY, TANKERS, OIL TRANSPORT,
1602 LEGISLATION, WASTE OIL, RECYCLING, STATE GOVERNMENTS, *LOCAL GOVERNMENTS,
1604 LEGISLATION, COMPENSATION, US, LIABILITY, SPILL CLEANUP,
1605 LEGISLATION, LIABILITY, OIL SPILLS, SAFETY, TANKERS, US, *CONGRESSIONAL BILLS,
1606 LEGISLATION, ENVIRONMENTAL PROTECTION, US, OFFSHORE DEVELOPMENT, OIL-GAS LEASING, ONSHORE IMPACTS, *OCS LANDS ACT AMENDMENTS,
1607 LEGISLATION, INTERNATIONAL AGREEMENTS, US, OIL SPILLS, SHIPS, TANKERS, *LEGAL PROBLEMS,
1608 LEGISLATION, COMPENSATION, OIL DISCHARGES, LIABILITY, US, STATE GOVERNMENTS, *NAVIGABLE WATERS,
1609 LEGISLATION, EPA, US, WATER QUALITY, PRODUCTION, *UNDERGROUND INJECTION,
1610 LEGISLATION, COST ANALYSIS, US, PORTS, TANKERS, OIL TRANSPORT, LIABILITY, *DEEPWATER PORT ACT,
1611 LEGISLATION, FOREIGN GOVERNMENTS, US, OIL DISCHARGES, POLLUTION PREVENTION, LIABILITY,
1613 LEGISLATION, FRANCE, POLLUTION PREVENTION, TANKERS, *FRENCH MARITIME LAW, *OLYMPIC BRAVERY SPILL,
1618 LEGISLATION, INTERNATIONAL CONVENTIONS, IMCO, POLLUTION PREVENTION,
1022 LIABILITY, FISHERIES, ENVIRONMENTAL EFFECTS, ARGO MERCHANT SPILL, TANKERS, SPILL CLEANUP,
1226 LIABILITY, CONTINGENCY PLANNING, ARGO MERCHANT SPILL, TANKERS, SAFETY, USCG, MEXICO/GULF OF, *FLAGS OF CONVENIENCE,
1227 LIABILITY, LEGISLATION, ENVIRONMENTAL EFFECTS, DEVELOPMENT, ALASKA, PIPELINES, OIL SPILLS,
1322 LIABILITY, CONTINGENCY PLANNING, OIL SPILLS, POLLUTION PREVENTION, *LEGAL RESPONSIBILITIES,
1327 LIABILITY, COMPENSATION, OIL SPILLS, POLLUTION PREVENTION, SPILL CLEANUP, *CONGRESSIONAL BILL,
1439 LIABILITY, INSURANCE, *MARINE INDUSTRY, TANKERS,
1529 LIABILITY, INSURANCE, REGULATIONS, SHIPS, PORTS, OFFSHORE DEVELOPMENT,
1602 LIABILITY, LEGISLATION, CALIFORNIA, OIL SPILLS, TANKERS, OIL TRANSPORT,
1604 LIABILITY, LEGISLATION, COMPENSATION, US, SPILL CLEANUP,
1605 LIABILITY, LEGISLATION, OIL SPILLS, SAFETY, TANKERS, US, *CONGRESSIONAL BILLS,
1608 LIABILITY, LEGISLATION, COMPENSATION, OIL DISCHARGES, US, STATE GOVERNMENTS, *NAVIGABLE WATERS,
1610 LIABILITY, LEGISLATION, COST ANALYSIS, US, PORTS, TANKERS, OIL TRANSPORT, *DEEPWATER PORT ACT,
1611 LIABILITY, LEGISLATION, FOREIGN GOVERNMENTS, US, OIL DISCHARGES, POLLUTION PREVENTION,
1612 LIABILITY, REGULATIONS, OFFSHORE DEVELOPMENT, NORTH SEA, NORWAY,
1615 LIABILITY, INTERNATIONAL CONVENTIONS, IMCO, HARBORS, COMPENSATION, COASTS, POLLUTION PREVENTION, SHIPS,
1616 LIABILITY, INTERNATIONAL CONVENTIONS, EUROPE, POLLUTION CONTROL, REGULATIONS, OFFSHORE DEVELOPMENT, NORTH SEA,
1622 LIABILITY, OIL TRANSPORT, TANKERS, REGULATIONS, SAFETY, USCG,
1209 LOUISIANA, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, *BAYOU CHOCTAW SALT DOME,
1212 LOUISIANA, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, WATER QUALITY, OIL SPILLS, *COTE BLANCHE MINE,
1215 LOUISIANA, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, WATER QUALITY, OIL SPILLS, *WEEKS ISLAND MINE,
1522 LOUISIANA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, OIL SPILLS, PIPELINES, MARSHES, *LAFOURCHE PARISH,
1244 LUBRICATING OIL, WASTE OIL TREATMENT, RECLAMATION, PATENT,
1310 LUBRICATING OIL, WASTE OIL TREATMENT, RECLAMATION, *BERC/ERDA SOLVENT,
1311 LUBRICATING OIL, RECLAMATION, SURFACTANTS, PATENT,
1312 LUBRICATING OIL, WASTE OILS, RECLAMATION, *REREFINING PROCESS,
1313 LUBRICATING OIL, FILTRATION, WASTE OIL, RECLAMATION, PATENT,
1315 LUBRICATING OIL, ENGLAND, WASTE OIL, RECYCLING,
1317 LUBRICATING OIL, GOVERNMENT AGENCIES, WASTE OIL, REFINING, RECLAMATION, REUSE,
1319 LUBRICATING OIL, FLOCCULATION, WASTE OIL TREATMENT, RECLAMATION, SURFACTANTS, PRECIPITATION, PATENT,
1320 LUBRICATING OIL, WASTE OIL, RECLAMATION, REFINING, PATENT,
1360 MAGELLAN/STRAIT OF, FISHERIES, BIRDS, BIOLOGICAL EFFECTS, ALGAE, METULA SPILL, MOLLUSKS,
1454 MAGELLAN/STRAIT OF, ENVIRONMENTAL EFFECTS, CRUDE OIL, METULA SPILL,
1020 MANUALS, INFORMATION SYSTEMS, OIL SPILLS,
1058 MANUALS, HYDROCARBONS, MONITORING, MOLLUSKS, UPTAKE, RELEASE, METABOLISM,
1238 MANUALS, WASTEWATER TREATMENT, OIL INDUSTRY, PETROCHEMICALS, REFINERIES, POLLUTION CONTROL,
1373 MARINE MAMMALS, HYDROCARBONS, ACUTE EFFECTS, TOXICITY, *SEALS, *PHOCA VITULINA,

1378 MARINE MAMMALS, BIOLOGICAL EFFECTS, ALASKA, OIL SPILLS, METABOLISM, *PHYSIOLOGY, *PINNIPEDS,
1420 MARINE MAMMALS, CRUDE OIL, ACUTE EFFECTS, TOXICITY, *RINGED SEALS,
1472 MARINE MAMMALS, BIOLOGICAL EFFECTS, BERING SEA, BEAUFORT SEA, MONITORING, OFFSHORE DEVELOPMENT, *BEARDED AND RINGED SEALS, *ECOLOGY,
1473 MARINE MAMMALS, DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT, *SPOTTED SEAL,
1474 MARINE MAMMALS, ICE, HABITAT, DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BEAUFORT SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT,
1475 MARINE MAMMALS, DISTRIBUTION, BIOLOGICAL EFFECTS, ALASKA/GULF OF, OFFSHORE DEVELOPMENT, *SEA LIONS, *ECOLOGY, *TROPHIC STRUCTURE,
1483 MARINE MAMMALS, BERING SEA, BASELINE STUDIES, TOXICITY, OFFSHORE DEVELOPMENT, *MORTALITY,
1487 MARINE MAMMALS, DISTRIBUTION, BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA/GULF OF, OFFSHORE DEVELOPMENT,
1488 MARINE MAMMALS, DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BEAUFORT SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT, OIL-GAS LEASING, OIL SPILLS,
1489 MARINE MAMMALS, DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT, *WHALES,
1490 MARINE MAMMALS, DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT, OIL-GAS LEASING,
1495 MARINE MAMMALS, DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BEAUFORT SEA, OFFSHORE DEVELOPMENT, OCS, *SEALS, *TROPHIC STRUCTURE,
1500 MARINE MAMMALS, FOOD WEB, CONTAMINANTS, BIOLOGICAL EFFECTS, ALASKA/GULF OF, OFFSHORE DEVELOPMENT, *ECOLOGY, *HARBOR SEAL,
1501 MARINE MAMMALS, DISTRIBUTION, BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA, OFFSHORE DEVELOPMENT, *SEA OTTERS,
1502 MARINE MAMMALS, HABITAT, DISTRIBUTION, CONTAMINATION, ALASKA, OFFSHORE DEVELOPMENT, *SEA OTTERS,
1531 MARINE MAMMALS, FISH, ENVIRONMENTAL EFFECTS, BIRDS, BEAUFORT SEA, OFFSHORE DRILLING, OIL SPILLS, SPREADING, MOVEMENT,
1032 MARINE ORGANISMS, DISTRIBUTION, BENTHOS, MONITORING, SEDIMENTS, UK, *SUBLITTORAL MACROFAUNA, *MILFORD HAVEN,
1043 MARINE ORGANISMS, BASELINE STUDIES, MONITORING, OFFSHORE DEVELOPMENT, NORTH SEA, *CELTIC SEA,
1054 MARINE ORGANISMS, HYDROCARBONS, ANALYTICAL TECHNIQUES, MONITORING, UPTAKE, METABOLISM,
1094 MARINE ORGANISMS, HYDROCARBONS, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, SEDIMENTS, SPECTROSCOPY, PUGET SOUND, WASHINGTON,
1100 MARINE ORGANISMS, HYDROCARBONS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, MOLLUSKS, *SOXHLET EXTRACTION, *SAPONIFICATION,
1118 MARINE ORGANISMS, HYDROCARBONS, DETECTION, CRANKCASE OIL, CHEMICAL ANALYSIS, WASTEWATERS, NEW YORK,
1150 MARINE ORGANISMS, DISPERSANTS, SOUTH AFRICA, SPILL CLEANUP, TOXICITY,
1203 MARINE ORGANISMS, FISHERIES, FATE, BIOLOGICAL EFFECTS, OIL TRANSPORT, OIL DISCHARGES, SOURCES, PACIFIC OCEAN,
1206 MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, OIL TRANSFER, PORTS, OIL DISCHARGES, UK, *MILFORD HAVEN,
1352 MARINE ORGANISMS, HYDROCARBONS, CHRONIC EFFECTS, NATURAL SEEPAGE, SANTA BARBARA CHANNEL,
1353 MARINE ORGANISMS, CRUDE OIL, CHRONIC EFFECTS, BIOLOGICAL EFFECTS, API, PLATFORMS, NATURAL SEEPAGE,
1357 MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, PORTS, OIL SPILLS, WASTEWATERS, REFINERIES, UK, *MILFORD HAVEN,
1361 MARINE ORGANISMS, FISH, BLACK SEA, BENTHOS, PETROLEUM PRODUCTS, TOXICITY, *SHRIMP, *ELECTRICAL CURRENTS,
1363 MARINE ORGANISMS, INTERTIDAL ZONE, FUEL OIL, CORALS, BIOLOGICAL EFFECTS, TROPICAL REGIONS,
1372 MARINE ORGANISMS, CONTAMINANTS, BEHAVIOR, TOXICITY, *SUBLETHAL EFFECTS,
1376 MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, ARCTIC, ALASKA, OIL SPILLS, *PRUDHOE BAY,
1382 MARINE ORGANISMS, CRUDE OIL, BACTERIA, *REFINED OIL, TOXICITY, METABOLISM, WEATHERING,
1392 MARINE ORGANISMS, FRANCE, ENVIRONMENTAL EFFECTS, BIODEGRADATION, BACTERIA, REFINERIES, WASTEWATERS, PHYTOPLANKTON,
1400 MARINE ORGANISMS, CRUDE OIL, CHRONIC EFFECTS, BIOLOGICAL EFFECTS, API, PLATFORMS, NATURAL SEEPAGE,
1402 MARINE ORGANISMS, BIOLOGICAL EFFECTS, OIL SPILLS, TANKERS, PORTS, MARSHES, METULA SPILL, UK, *MILFORD HAVEN,
1403 MARINE ORGANISMS, FUEL OIL, ECHINODERMS, CRUDE OIL, TOXICITY, *SAND DOLLARS,
1405 MARINE ORGANISMS, CONTAMINATION, BIOLOGICAL EFFECTS, *METABOLIC INTERACTIONS,
1407 MARINE ORGANISMS, CHRONIC EFFECTS, BIOLOGICAL EFFECTS, OIL SPILLS,
1410 MARINE ORGANISMS, INVERTEBRATES, CRUDE OIL, BIOLOGICAL EFFECTS, BEHAVIOR, ARCTIC, METABOLISM,
1414 MARINE ORGANISMS, CRUDE OIL, CHRONIC EFFECTS, ALASKA, ACUTE EFFECTS, TOXICITY, METABOLISM,
1417 MARINE ORGANISMS, HYDROCARBONS, BIOLOGICAL EFFECTS, ANALYTICAL TECHNIQUES, *SPIN-LABELING TECHNIQUES,

1421 MARINE ORGANISMS, INDUSTRIES, HYDROCARBONS, ECOSYSTEMS, COASTS, WASTEWATERS,
1427 MARINE ORGANISMS, EMULSIFIERS, TOXICITY, PHYTOPLANKTON,
1432 MARINE ORGANISMS, CONTAMINANTS, BIOLOGICAL EFFECTS, PETROLEUM PRODUCTS, *PHYSIOLOGICAL RESPONSE,
1444 MARINE ORGANISMS, FATE, BIOLOGICAL EFFECTS, ATLANTIC OCEAN, ARGO MERCHANT SPILL,
1453 MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, DISPERSANTS, SPILL CLEANUP, URQUIOLA SPILL, SPAIN,
1458 MARINE ORGANISMS, HYDROCARBONS, OCEANS,
1468 MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, API, OFFSHORE PRODUCTION, PLATFORMS, NATURAL SEEPAGE,
1471 MARINE ORGANISMS, HABITAT, COASTS, BIOLOGICAL EFFECTS, BEAUFORT SEA, BASELINE STUDIES, MONITORING, OFFSHORE DEVELOPMENT,
1496 MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, DISPOSAL, OFFSHORE DRILLING, *DRILLING WASTES,
1498 MARINE ORGANISMS, DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, MONITORING, OFFSHORE DEVELOPMENT,
1505 MARINE ORGANISMS, INTERTIDAL ZONE, DISTRIBUTION, COASTS, CHRONIC EFFECTS, BERING SEA, BASELINE STUDIES, ALASKA/GULF OF, ACUTE EFFECTS, MONITORING,
1523 MARINE ORGANISMS, ICE, ENVIRONMENTAL EFFECTS, BEAUFORT SEA, BASELINE STUDIES, ARCTIC, OFFSHORE DRILLING, SPILL CLEANUP,
1533 MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, BIRDS, BASELINE STUDIES, ALASKA, OFFSHORE DEVELOPMENT, OCS,
1579 MARINE ORGANISMS, FUEL OIL, FATE, CONTAMINATION, BIOLOGICAL EFFECTS, ATLANTIC OCEAN, ARGO MERCHANT SPILL, NOAA,
1581 MARINE ORGANISMS, FUEL OIL, FISHERIES, FATE, CONTAMINATION, ATLANTIC OCEAN, ARGO MERCHANT SPILL, MODELS, MOVEMENT, NOAA,
1584 MARINE ORGANISMS, HYDROCARBONS, FATE, DISTRIBUTION, BIOLOGICAL EFFECTS, OIL SPILLS, MARSHES, METABOLISM, MASSACHUSETTS,
1587 MARINE ORGANISMS, FATE, ENVIRONMENTAL EFFECTS, DISPERSIONS, MODELS, OCEANS, SPILL CONTAINMENT,
1595 MARINE ORGANISMS, FATE, CHRONIC EFFECTS, BIOLOGICAL EFFECTS, ACUTE EFFECTS, OIL DISCHARGES, NORTH SEA,
1625 MARINE ORGANISMS, HYDROCARBONS, CHEMICAL ANALYSIS, BIBLIOGRAPHIES, OIL INDUSTRY, OIL SPILLS, SOURCE IDENTIFICATION,
1628 MARINE ORGANISMS, CONTAMINATION, BIRDS, BIBLIOGRAPHIES, WILDLIFE, *ENDANGERED SPECIES, *WATER POLLUTION,
1629 MARINE ORGANISMS, BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, BASELINE STUDIES, ARCTIC, OIL SPILLS, SUBARCTIC REGIONS,
1633 MARINE ORGANISMS, FATE, BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, OIL SPILLS, SPILL CLEANUP,
1359 MARSHES, BIOLOGICAL EFFECTS, WASTEWATERS, REFINERIES, SHORELINES, VEGETATION, UK,
1365 MARSHES, BIOLOGICAL EFFECTS, OIL SPILLS, PLANTS, SAMPLING, *SPECIES REDUCTION,
1371 MARSHES, BIOLOGICAL EFFECTS, WASTEWATERS, REFINERIES, VEGETATION, UK, *SALTMARSH,
1389 MARSHES, CRUDE OIL, BIOLOGICAL EFFECTS, PHYTOPLANKTON, *ENVIRONMENTAL STRESS, *DIATOMS,
1402 MARSHES, MARINE ORGANISMS, BIOLOGICAL EFFECTS, OIL SPILLS, TANKERS, PORTS, METULA SPILL, UK, *MILFORD HAVEN,
1522 MARSHES, LOUISIANA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, OIL SPILLS, PIPELINES, *LAFOURCHE PARISH,
1544 MARSHES, ESTUARIES, CRUDE OIL, BIODEGRADATION, MICROORGANISMS,
1584 MARSHES, MARINE ORGANISMS, HYDROCARBONS, FATE, DISTRIBUTION, BIOLOGICAL EFFECTS, OIL SPILLS, METABOLISM, MASSACHUSETTS,
1024 MASSACHUSETTS, FUEL OIL, FISHERIES, CONTAMINATION, OIL SPILLS, *BUZZARDS BAY, *SHELLFISH RESOURCES,
1584 MASSACHUSETTS, MARSHES, MARINE ORGANISMS, HYDROCARBONS, FATE, DISTRIBUTION, BIOLOGICAL EFFECTS, OIL SPILLS, METABOLISM,
1034 MEDITERRANEAN SEA, HYDROCARBONS, CONTAMINANTS, COASTS, BASELINE STUDIES, MONITORING, *POLLUTANT TRANSPORT,
1129 MEDITERRANEAN SEA, ISRAEL, CRUDE OIL, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, SAMPLING, *TAR BALLS, WEATHERING,
1052 METABOLISM, HYDROCARBONS, ESTUARIES, CONTAMINATION, MONITORING, MOLLUSKS, *ADENYLATE ENERGY CHARGE, *ENVIRONMENTAL STRESS,
1054 METABOLISM, MARINE ORGANISMS, HYDROCARBONS, ANALYTICAL TECHNIQUES, MONITORING, UPTAKE,
1058 METABOLISM, MANUALS, HYDROCARBONS, MONITORING, MOLLUSKS, UPTAKE, RELEASE,
1377 METABOLISM, HYDROCARBONS, FISH, CRUSTACEANS, UPTAKE, RELEASE, *LABELED N-ALKANES,
1378 METABOLISM, MARINE MAMMALS, BIOLOGICAL EFFECTS, ALASKA, OIL SPILLS, *PHYSIOLOGY, *PINNIPEDS,
1382 METABOLISM, MARINE ORGANISMS, CRUDE OIL, BACTERIA, *REFINED OIL, TOXICITY, WEATHERING,
1397 METABOLISM, INVERTEBRATES, FISH, TOXICITY, PETROLEUM PRODUCTS,
1404 METABOLISM, BIOLOGICAL EFFECTS, ALGAE, UPTAKE, *PHOTOSYNTHESIS, *RESPIRATION,
1410 METABOLISM, MARINE ORGANISMS, INVERTEBRATES, CRUDE OIL, BIOLOGICAL EFFECTS, BEHAVIOR, ARCTIC,
1414 METABOLISM, MARINE ORGANISMS, CRUDE OIL, CHRONIC EFFECTS, ALASKA, ACUTE EFFECTS, TOXICITY,
1423 METABOLISM, FUEL OIL, CRUDE OIL, TOXICITY, MOLLUSKS, *CLAMS, *MYA ARENARIA,
1429 METABOLISM, HYDROCARBONS, BIOLOGICAL EFFECTS, ALGAE, *NAPHTHALENE,
1558 METABOLISM, HYDROCARBONS, BIODEGRADATION, BACTERIA,

1561 METABOLISM, CRUDE OIL, BIODEGRADATION, BEAUFORT SEA, BASELINE STUDIES, BACTERIA, ALASKA/GULF OF, ACUTE EFFECTS, UPTAKE,

1565 METABOLISM, HYDROCARBONS, ESTUARIES, BIODEGRADATION, BACTERIA, *CYCLOHEXANE,

1584 METABOLISM, MASSACHUSETTS, MARSHES, MARINE ORGANISMS, HYDROCARBONS, FATE, DISTRIBUTION, BIOLOGICAL EFFECTS, OIL SPILLS,

1360 METULA SPILL, MAGELLAN/STRAIT OF, FISHERIES, BIRDS, BIOLOGICAL EFFECTS, ALGAE, MOLLUSKS,

1402 METULA SPILL, MARSHES, MARINE ORGANISMS, BIOLOGICAL EFFECTS, OIL SPILLS, TANKERS, PORTS, UK, *MILFORD HAVEN,

1454 METULA SPILL, MAGELLAN/STRAIT OF, ENVIRONMENTAL EFFECTS, CRUDE OIL,

1017 MEXICO/GULF OF, OIL SPILLS, OCS, OFFSHORE DRILLING,

1092 MEXICO/GULF OF, HYDROCARBONS, CHEMICAL ANALYSIS, SAMPLING, REFINERIES, PETROCHEMICALS, SOURCES, *MISSISSIPPI DELTA,

1099 MEXICO/GULF OF, HYDROCARBONS, DISTRIBUTION, CHEMICAL ANALYSIS, BENTHOS, OCS, TEXAS,

1226 MEXICO/GULF OF, LIABILITY, CONTINGENCY PLANNING, ARGO MERCHANT SPILL, TANKERS, SAFETY, USCG, *FLAGS OF CONVENIENCE,

1341 MICHIGAN, POLLUTION PREVENTION, WASTEWATER TREATMENT, *FREEWAY RUNOFF,

1082 MICROORGANISMS, DISTRIBUTION, BIOLOGICAL EFFECTS, ATLANTIC COAST, SAMPLING, SEAWATER, SEDIMENTS, OFFSHORE DRILLING,

1160 MICROORGANISMS, BIODEGRADATION, SPILL DISPOSAL, SOIL, PATENT,

1175 MICROORGANISMS, BIODEGRADATION, OIL SLICKS, SPILL CLEANUP, PATENT, *NUTRIENT PARTICLES,

1354 MICROORGANISMS, FUEL OIL, OIL SPILLS, TOXICITY, YEASTS, *ULTRAVIOLET LIGHT EXPOSURE,

1448 MICROORGANISMS, ENVIRONMENTAL EFFECTS, CRUDE OIL, SEDIMENTS, OFFSHORE DEVELOPMENT, RELEASE, *TRACE METALS,

1544 MICROORGANISMS, MARSHES, ESTUARIES, CRUDE OIL, BIODEGRADATION,

1545 MICROORGANISMS, HYDROCARBONS, BIODEGRADATION, BEAUFORT SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT, OCS,

1546 MICROORGANISMS, HYDROCARBONS, BIODEGRADATION, BASELINE STUDIES, ALASKA/GULF OF, OFFSHORE DEVELOPMENT, OCS,

1552 MICROORGANISMS, HYDROCARBONS, BIODEGRADATION, *AQUATIC ENVIRONMENT,

1553 MICROORGANISMS, CRUDE OIL, BIOLOGICAL EFFECTS, BIODEGRADATION, BEAUFORT SEA, SAMPLING,

1554 MICROORGANISMS, HYDROCARBONS, CRUDE OIL, BIODEGRADATION, ATLANTIC OCEAN, SAMPLING,

1556 MICROORGANISMS, CRUDE OIL, BIODEGRADATION, BEACHES, OXIDATION, *BEACH GRAVEL,

1557 MICROORGANISMS, FUELS, BIODEGRADATION, PETROLEUM PRODUCTS,

1559 MICROORGANISMS, HYDROCARBONS, BIODEGRADATION, POLLUTION CONTROL,

1563 MICROORGANISMS, CRUDE OIL, BIODEGRADATION, ATLANTIC COAST, SAMPLING, OFFSHORE DRILLING, *OIL DEVELOPMENT SITES,

1567 MICROORGANISMS, CHESAPEAKE BAY, BIODEGRADATION, BACTERIA, AROMATIC HYDROCARBONS, SEDIMENTS,

1568 MICROORGANISMS, ESTUARIES, CRUDE OIL, BIODEGRADATION, BACTERIA,

1085 MISSISSIPPI, HYDROCARBONS, ESTUARIES, ALABAMA, SAMPLING, SEDIMENTS, OCS, OIL SPILLS, TOXICITY,

1080 MODELS, DETECTION, COASTS, REMOTE SENSING, OIL SPILLS, POLLUTION PREVENTION, *LINEAR PROGRAMMING,

1089 MODELS, CARCINOGENS, PAH, *BENZO(A)ANTHRACENE,

1115 MODELS, ENVIRONMENTAL EFFECTS, ECONOMICS, TANKERS, OIL SPILLS, *OPTIMAL TANKER SIZE,

1172 MODELS, BOOMS, SPILL CONTAINMENT, SPILL CLEANUP, SKIMMERS, *HYDRODYNAMIC PROBLEMS,

1220 MODELS, OIL TRANSFER, TANKERS, *ICE COOLING RATES,

1222 MODELS, ENVIRONMENTAL EFFECTS, COST ANALYSIS, OIL TRANSFER, OFFSHORE DEVELOPMENT, SOCIO-ECONOMIC EFFECTS, SPREADING,

1223 MODELS, LEAKAGE, FATE, EVAPORATION, OIL TRANSPORT, PIPELINES, OIL SPILLS, SPREADING, *IGNITION HAZARDS,

1440 MODELS, ECONOMIC EFFECTS, REFINERIES, WASTEWATERS, POLLUTION CONTROL, *INDUSTRY COSTS,

1447 MODELS, ALASKA, OFFSHORE DEVELOPMENT, ONSHORE IMPACTS,

1516 MODELS, GROUNDWATER, ENVIRONMENTAL EFFECTS, PRODUCTION, *TERTIARY OIL RECOVERY METHODS, WATER QUALITY,

1540 MODELS, FATE, OIL WELLS, *SUBMARINE BLOWOUT SIMULATION, CONTAINMENT,

1572 MODELS, HYDROCARBONS, EVAPORATION, CRUDE OIL, OIL SPILLS, SOLUTION, TOXICITY,

1580 MODELS, ENVIRONMENTAL EFFECTS, COST ANALYSIS, OIL SPILLS, NORTH SEA, *COMPUTER SIMULATION,

1581 MODELS, MARINE ORGANISMS, FUEL OIL, FISHERIES, FATE, CONTAMINATION, ATLANTIC OCEAN, ARGO MERCHANT SPILL, MOVEMENT, NOAA,

1583 MODELS, FATE, OIL SPILLS, MOVEMENT, *GULF STREAM,

1585 MODELS, FATE, CONTAMINANTS, MOVEMENT, OFFSHORE DRILLING, PRUDHOE BAY, *OCEAN CIRCULATION, *POLLUTANT TRANSPORT,

1586 MODELS, CANADA, OIL SLICKS, MOVEMENT,

1587 MODELS, MARINE ORGANISMS, FATE, ENVIRONMENTAL EFFECTS, DISPERSIONS, OCEANS, SPILL CONTAINMENT,

1590 MODELS, FATE, BASELINE STUDIES, ALASKA, *CIRCULATION, OCS, OIL SPILLS, *TRAJECTORY ANALYSIS,

1599 MODELS, FATE, OIL SPILLS, OCEANS, *COMPUTER PROGRAMMING,

1600 MODELS, DRIFT, OIL SPILLS, MOVEMENT, *COMPUTER MODELING,

1035 MOLLUSKS, ENVIRONMENTAL EFFECTS, BASELINE STUDIES, MONITORING, SEDIMENTS, PUGET SOUND, OIL SPILLS, NOAA,

1046 MOLLUSKS, CRUSTACEANS, COST ANALYSIS, CONTAMINANTS, MONITORING, *MUSSELS, *BARNACLES,

1052 MOLLUSKS, METABOLISM, HYDROCARBONS, ESTUARIES, CONTAMINATION, MONITORING, *ADENYLATE ENERGY CHARGE, *ENVIRONMENTAL STRESS,
1058 MOLLUSKS, METABOLISM, MANUALS, HYDROCARBONS, MONITORING, UPTAKE, RELEASE,
1100 MOLLUSKS, MARINE ORGANISMS, HYDROCARBONS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, *SOXHLET EXTRACTION, *SAPONIFICATION,
1351 MOLLUSKS, FUEL OIL, DISPERSIONS, CRUDE OIL, TOXICITY, *OYSTER, *CRASSOSTREA, VIRGINICA,
1360 MOLLUSKS, METULA SPILL, MAGELLAN/STRAIT OF, FISHERIES, BIRDS, BIOLOGICAL EFFECTS, ALGAE,
1366 MOLLUSKS, FUEL OIL, CRUDE OIL, TOXICITY, WASTE OIL, *CLAMS, *MERCENARIA,
1383 MOLLUSKS, CALIFORNIA/SOUTHERN, BIOLOGICAL EFFECTS, PETROLEUM PRODUCTS, *TOLERANCE VARIABILITY, *LITTORINA,
1387 MOLLUSKS, HABITAT, BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA/GULF OF, OIL SPILLS, OCS, OFFSHORE DEVELOPMENT, *CLAMS,
1388 MOLLUSKS, CRUDE OIL, BIOLOGICAL EFFECTS, *LARVAE, *OXYGEN UPTAKE , *MERETRIX LUSORIA,
1422 MOLLUSKS, FUEL OIL, BIOLOGICAL EFFECTS, *CLAMS, *MYA ARENARIA,
1423 MOLLUSKS, METABOLISM, FUEL OIL, CRUDE OIL, TOXICITY, *CLAMS, *MYA ARENARIA,
1424 MOLLUSKS, INTERTIDAL ZONE, FUEL OIL, CHRONIC EFFECTS, ACUTE EFFECTS, OIL SPILLS, TOXICITY, *HONG KONG,
1426 MOLLUSKS, CRUDE OIL, BIOLOGICAL EFFECTS, ALASKA, SEDIMENTS, *CLAMS, *INDICATOR SPECIES, *MACOMA BALTHICA,
1430 MOLLUSKS, FUEL OIL, EMULSIONS, DISPERSANTS, CRUDE OIL, TOXICITY, UK,
1435 MOLLUSKS, CRUDE OIL, BIOLOGICAL EFFECTS, *CLAMS,
1436 MOLLUSKS, CRUDE OIL, BIOLOGICAL EFFECTS, *CLAMS,
1011 MONITORING, OIL SPILLS, *EKOFISK BLOWOUT, SPILL CLEANUP, NORTH SEA, NORWAY,
1012 MONITORING, CONTAMINATION, BIRDS, UK, *BIRD MORTALITY,
1031 MONITORING, FATE, CONTAMINANTS, BEAUFORT SEA, BASELINE STUDIES, *OCEAN CURRENTS, OCS, OFFSHORE DEVELOPMENT,
1032 MONITORING, MARINE ORGANISMS, DISTRIBUTION, BENTHOS, SEDIMENTS, UK, *SUBLITTORAL MACROFAUNA, *MILFORD HAVEN,
1033 MONITORING, BALLAST, OIL SLICKS, POLLUTION PREVENTION, TANKERS, *OIL-WATER INTERFACE,
1034 MONITORING, MEDITERRANEAN SEA, HYDROCARBONS, CONTAMINANTS, COASTS, BASELINE STUDIES, *POLLUTANT TRANSPORT,
1035 MONITORING, MOLLUSKS, ENVIRONMENTAL EFFECTS, BASELINE STUDIES, SEDIMENTS, PUGET SOUND, OIL SPILLS, NOAA,
1036 MONITORING, BILGES, BALLAST, OIL DISCHARGES, SHIPS,
1037 MONITORING, ESTUARIES, CONTAMINANTS, COASTS, *METHODS, *INDICATOR ORGANISMS,
1038 MONITORING, ESTUARIES, ENVIRONMENTAL EFFECTS, COASTS, BASELINE STUDIES, ALASKA, *STREAMFLOW, OFFSHORE DEVELOPMENT, OIL SPILLS,
1039 MONITORING, HYDROCARBONS, BALLAST, PETROLEUM PRODUCTS, WASTEWATERS, PATENT, *SOUND VELOCITY CHARACTERISTICS,
1040 MONITORING, HYDROCARBONS, DISTRIBUTION, BERING SEA, BASELINE STUDIES, OCS, OFFSHORE DEVELOPMENT, *NATURALLY-OCCURRING HYDROCARBONS,
1041 MONITORING, GROUNDWATER, DESIGN-ENGINEERING, CONTAMINATION, SPILL CLEANUP,
1042 MONITORING, DESIGN-ENGINEERING, BALLAST, OIL SLICKS, TANKERS, PATENT,
1043 MONITORING, MARINE ORGANISMS, BASELINE STUDIES, OFFSHORE DEVELOPMENT, NORTH SEA, *CELTIC SEA,
1044 MONITORING, LEAKAGE, DETECTION, PIPELINES, PATENT, *MOBILE RECEIVER,
1045 MONITORING, DESIGN-ENGINEERING, OIL SLICKS, *SPILL TRACKING BUOY,
1046 MONITORING, MOLLUSKS, CRUSTACEANS, COST ANALYSIS, CONTAMINANTS, *MUSSELS, *BARNACLES,
1047 MONITORING, ENVIRONMENTAL EFFECTS, ALASKA/GULF OF, OCEANS, *CIRCULATION PATTERNS, OCS, OFFSHORE DEVELOPMENT,
1048 MONITORING, GOVERNMENT AGENCIES, ENVIRONMENTAL PROTECTION, OIL DISCHARGES, OIL INDUSTRY,
1049 MONITORING, DETECTION, BILGES, BALLAST, ANALYTICAL TECHNIQUES, SPECTROMETRY, WASTE OIL, *SUMMING LUMINESCENCE SPECTROMETRY,
1050 MONITORING, DESIGN-ENGINEERING, OFFSHORE DRILLING, PATENT, *OIL-IN-WATER,
1051 MONITORING, HYDROCARBONS, CRUSTACEANS, SEAWATER, *MOTOR BEHAVIOR,
1052 MONITORING, MOLLUSKS, METABOLISM, HYDROCARBONS, ESTUARIES, CONTAMINATION, *ADENYLATE ENERGY CHARGE, *ENVIRONMENTAL STRESS,
1053 MONITORING, DETECTION, CONTAMINANTS, *OIL-IN-WATER, PATENT,
1054 MONITORING, METABOLISM, MARINE ORGANISMS, HYDROCARBONS, ANALYTICAL TECHNIQUES, UPTAKE,
1055 MONITORING, WASTE OIL, REFINERIES, SAMPLING, WASTEWATERS,
1056 MONITORING, FISH, CRUDE OIL, CHROMATOGRAPHY, CHEMICAL ANALYSIS, *EELS, *BIO-INDICATORS,
1057 MONITORING, BALTIC SEA, PETROLEUM PRODUCTS, NORTH SEA, NORWEGIAN SEA,
1058 MONITORING, MOLLUSKS, METABOLISM, MANUALS, HYDROCARBONS, UPTAKE, RELEASE,
1059 MONITORING, FATE, CONTAMINANTS, COASTS, BASELINE STUDIES, ALASKA, *WIND CONDITIONS, OFFSHORE DEVELOPMENT,
1060 MONITORING, FATE, CONTAMINANTS, BASELINE STUDIES, ALASKA/GULF OF, *OCEAN CURRENTS, OFFSHORE DEVELOPMENT,
1061 MONITORING, ENVIRONMENTAL EFFECTS, BERING SEA, BEAUFORT SEA, BASELINE STUDIES, ALASKA/GULF OF, *MARINE CLIMATOLOGY, OFFSHORE DEVELOPMENT,
1062 MONITORING, HYDROCARBONS, FATE, DISTRIBUTION, BASELINE STUDIES, ALASKA, OCS,
1063 MONITORING, INTERTIDAL ZONE, CRUDE OIL, ALASKA, SEDIMENTS, UPTAKE, RELEASE, *PORT VALDEZ,
1064 MONITORING, LEAKAGE, PIPELINES, OIL TRANSPORT, *PIPELINE LEAK DETECTORS,

1065 MONITORING, FUEL OIL, DETECTION, DESIGN-ENGINEERING, BILGES, SHIPS, *OIL-IN-WATER DETECTOR,
1066 MONITORING, CONTAMINANTS, POLLUTION PREVENTION, *UN,
1067 MONITORING, CHEMICAL ANALYSIS, AROMATIC HYDROCARBONS, WASTEWATERS, REFINERIES, *COLORIMETRY,
1068 MONITORING, FUEL OIL, DETECTION, DESIGN-ENGINEERING, CRUDE OIL, CONTAMINANTS, PATENT, *OPTICAL SENSOR,
1069 MONITORING, DESIGN-ENGINEERING, OIL SLICKS, PATENT, *LIGHT SENSOR,
1070 MONITORING, DISTRIBUTION, COASTS, BEAUFORT SEA, TAR, SOURCES,
1077 MONITORING, REMOTE SENSING, OIL SLICKS, MOVEMENT, *SATELLITE-AIRCRAFT-DROGUE STUDIES,
1090 MONITORING, ANALYTICAL TECHNIQUES, WASTEWATERS, REFINERIES, TOXICITY,
1221 MONITORING, IMCO, REGULATIONS, POLLUTION PREVENTION, SHIPS,
1304 MONITORING, BILGES, WASTE OIL DISPOSAL, TANKERS, RHINE RIVER, *COMPUTER SURVEILLANCE,
1330 MONITORING, IMCO, OIL DISCHARGES, TANKERS, POLLUTION CONTROL, REGULATIONS, *BAILEY MONITOR PROGRAM,
1335 MONITORING, LEGISLATION, ENVIRONMENTAL EFFECTS, OIL INDUSTRY, UK, OIL SPILLS, WASTEWATERS,
1337 MONITORING, DISPOSAL, DETECTION, BEAUFORT SEA, SPILL CLEANUP, POLLUTION CONTROL, *EQUIPMENT EVALUATION,
1358 MONITORING, BIOLOGICAL EFFECTS, OIL SPILLS, WASTEWATERS, REFINERIES, PORTS, UK, *MILFORD HAVEN, *OIL POLLUTION RESEARCH UNIT,
1457 MONITORING, DISPERSANTS, CONTAMINATION, OIL SPILLS, REFINERIES, TOXICITY, *BOOK REVIEW,
1462 MONITORING, FISHERIES, ENVIRONMENTAL EFFECTS, CHINA, OIL SPILLS, PLANKTON, *HONG KONG,
1467 MONITORING, ICE, FOOD WEB, BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, PHYTOPLANKTON, OFFSHORE DEVELOPMENT,
1469 MONITORING, FISHERIES, ESTUARIES, DISTRIBUTION, BIOLOGICAL EFFECTS, BEAUFORT SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT,
1471 MONITORING, MARINE ORGANISMS, HABITAT, COASTS, BIOLOGICAL EFFECTS, BEAUFORT SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT,
1472 MONITORING, MARINE MAMMALS, BIOLOGICAL EFFECTS, BERING SEA, BEAUFORT SEA, OFFSHORE DEVELOPMENT, *BEARDED AND RINGED SEALS, *ECOLOGY,
1480 MONITORING, DISTRIBUTION, BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA/GULF OF, ZOOPLANKTON, OFFSHORE DEVELOPMENT,
1481 MONITORING, DISTRIBUTION, BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA/GULF OF, PLANKTON, *ICHTHYOPLANKTON, OFFSHORE DEVELOPMENT,
1482 MONITORING, DISTRIBUTION, BIBLIOGRAPHIES, BEAUFORT SEA, BASELINE STUDIES, PLANKTON,
1485 MONITORING, DISTRIBUTION, BIOLOGICAL EFFECTS, BENTHOS, BASELINE STUDIES, ALASKA/GULF OF, *PRODUCTIVITY, STATISTICAL ANALYSIS, OFFSHORE DEVELOPMENT,
1491 MONITORING, ENVIRONMENTAL EFFECTS, BENTHOS, BASELINE STUDIES, ALASKA, SEDIMENTS, OCS, OFFSHORE DEVELOPMENT,
1494 MONITORING, BIOLOGICAL EFFECTS, BASELINE STUDIES, PHYTOPLANKTON, OFFSHORE DEVELOPMENT, *PRIMARY PRODUCTION,
1497 MONITORING, FISH, ENVIRONMENTAL EFFECTS, BERING SEA, BEAUFORT SEA, BASELINE STUDIES, ALASKA/GULF OF, OFFSHORE DEVELOPMENT, OCS, *FISH DISEASES,
1498 MONITORING, MARINE ORGANISMS, DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT,
1505 MONITORING, MARINE ORGANISMS, INTERTIDAL ZONE, DISTRIBUTION, COASTS, CHRONIC EFFECTS, BERING SEA, BASELINE STUDIES, ALASKA/GULF OF, ACUTE EFFECTS,
1547 MONITORING, CRUSTACEANS, CRUDE OIL, BIODEGRADATION, ARCTIC, PETROLEUM PRODUCTS, TOXICITY, *AMPHIPODS,
1550 MONITORING, HYDROCARBONS, COASTS, BIODEGRADATION, BACTERIA,
1594 MONITORING, ICE, CRUDE OIL, ARCTIC, SPREADING, MOVEMENT, WEATHERING, SPILL CLEANUP,
1617 MONITORING, INTERNATIONAL CONVENTIONS, IMCO, TANKERS, POLLUTION PREVENTION, OIL DISCHARGES, OIL-WATER SEPARATION,
1621 MONITORING, GUIDELINES, CANADA, POLLUTION CONTROL, REFINERIES, WASTEWATERS, REGULATIONS,
1023 MOVEMENT, JAPAN, FUEL OIL, ENVIRONMENTAL EFFECTS, OIL SPILLS, SPILL CLEANUP, *INLAND SEA,
1077 MOVEMENT, MONITORING, REMOTE SENSING, OIL SLICKS, *SATELLITE-AIRCRAFT-DROGUE STUDIES,
1386 MOVEMENT, ENVIRONMENTAL EFFECTS, ATLANTIC COAST, OIL SPILLS, WWII SPILLS, TANKERS,
1531 MOVEMENT, MARINE MAMMALS, FISH, ENVIRONMENTAL EFFECTS, BIRDS, BEAUFORT SEA, OFFSHORE DRILLING, OIL SPILLS, SPREADING,
1575 MOVEMENT, ICE, CRUDE OIL,
1576 MOVEMENT, OIL SPILLS, SPREADING, *WAVE INTERACTION ANALYSIS,
1581 MOVEMENT, MODELS, MARINE ORGANISMS, FUEL OIL, FISHERIES, FATE, CONTAMINATION, ATLANTIC OCEAN, ARGO MERCHANT SPILL, NOAA,
1583 MOVEMENT, MODELS, FATE, OIL SPILLS, *GULF STREAM,
1585 MOVEMENT, MODELS, FATE, CONTAMINANTS, OFFSHORE DRILLING, PRUDHOE BAY, *OCEAN CIRCULATION, *POLLUTANT TRANSPORT,
1586 MOVEMENT, MODELS, CANADA, OIL SLICKS,
1588 MOVEMENT, BASELINE STUDIES, ALASKA/GULF OF, OIL SPILLS, OFFSHORE DRILLING, *OCEAN CIRCULATION,
1592 MOVEMENT, COASTS, BEAUFORT SEA, OIL SLICKS, *IMPACT LOCATIONS,
1594 MOVEMENT, MONITORING, ICE, CRUDE OIL, ARCTIC, SPREADING, WEATHERING, SPILL CLEANUP,
1600 MOVEMENT, MODELS, DRIFT, OIL SPILLS, *COMPUTER MODELING,

1352 NATURAL SEEPAGE, MARINE ORGANISMS, HYDROCARBONS, CHRONIC EFFECTS, SANTA BARBARA CHANNEL,
1353 NATURAL SEEPAGE, MARINE ORGANISMS, CRUDE OIL, CHRONIC EFFECTS, BIOLOGICAL EFFECTS, API, PLATFORMS,
1400 NATURAL SEEPAGE, MARINE ORGANISMS, CRUDE OIL, CHRONIC EFFECTS, BIOLOGICAL EFFECTS, API, PLATFORMS,
1468 NATURAL SEEPAGE, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, API, OFFSHORE PRODUCTION, PLATFORMS,
1339 NETHERLANDS, LEGISLATION, LAW ENFORCEMENT, HARBORS, POLLUTION CONTROL, TANKERS, WATER QUALITY,
1566 NEUSTON, CASPIAN SEA, BLACK SEA, BIODEGRADATION, BACTERIA, ALASKA/GULF OF, OIL SLICKS, *AZOV SEA,
1535 NEW JERSEY, DELAWARE, COASTS, OFFSHORE DEVELOPMENT, ONSHORE IMPACTS, PORTS, SOCIO-ECONOMIC EFFECTS,
1601 NEW JERSEY, LEGISLATION, COMPENSATION, REGULATIONS, SPILL CLEANUP, STATE GOVERNMENTS, OIL TRANSFER,
1118 NEW YORK, MARINE ORGANISMS, HYDROCARBONS, DETECTION, CRANKCASE OIL, CHEMICAL ANALYSIS, WASTEWATERS,
1035 NOAA, MONITORING, MOLLUSKS, ENVIRONMENTAL EFFECTS, BASELINE STUDIES, SEDIMENTS, PUGET SOUND, OIL SPILLS,
1579 NOAA, MARINE ORGANISMS, FUEL OIL, FATE, CONTAMINATION, BIOLOGICAL EFFECTS, ATLANTIC OCEAN, ARGO MERCHANT SPILL,
1581 NOAA, MOVEMENT, MODELS, MARINE ORGANISMS, FUEL OIL, FISHERIES, FATE, CONTAMINATION, ATLANTIC OCEAN, ARGO MERCHANT SPILL,
1005 NORTH SEA, OIL SPILLS, OFFSHORE DRILLING, SPILL CONTAINMENT, *WELL BLOWOUT,
1007 NORTH SEA, OIL SPILLS, *EKOFISK BLOWOUT, SPILL CLEANUP, NORWAY,
1108 NORTH SEA, BEACHES, OIL SPILLS, SCOTLAND,
1009 NORTH SEA, OIL SPILLS, OFFSHORE DRILLING, SPILL CONTAINMENT, *EKOFISK WELL BLOWOUT,
1011 NORTH SEA, MONITORING, OIL SPILLS, *EKOFISK BLOWOUT, SPILL CLEANUP, NORWAY,
1043 NORTH SEA, MONITORING, MARINE ORGANISMS, BASELINE STUDIES, OFFSHORE DEVELOPMENT, *CELTIC SEA,
1057 NORTH SEA, MONITORING, BALTIC SEA, PETROLEUM PRODUCTS, NORWEGIAN SEA,
1147 NORTH SEA, ENVIRONMENTAL PROTECTION, ECONOMICS, SPILL CLEANUP, OFFSHORE DEVELOPMENT, SAFETY, NORWAY,
1162 NORTH SEA, OFFSHORE DEVELOPMENT, OIL-WATER SEPARATION,
1329 NORTH SEA, FATE, ENVIRONMENTAL EFFECTS, CRUDE OIL, POLLUTION PREVENTION, OFFSHORE DRILLING, OIL TRANSPORT, SPILL CLEANUP,
1333 NORTH SEA, OFFSHORE DEVELOPMENT, POLLUTION PREVENTION, OIL SPILLS, *SUPPORT SYSTEMS,
1580 NORTH SEA, MODELS, ENVIRONMENTAL EFFECTS, COST ANALYSIS, OIL SPILLS, *COMPUTER SIMULATION,
1582 NORTH SEA, FATE, EVAPORATION, DISPERSIONS, OFFSHORE DRILLING, OIL SPILLS, SPILL RECOVERY, *EKOFISK WELL BLOWOUT,
1595 NORTH SEA, MARINE ORGANISMS, FATE, CHRONIC EFFECTS, BIOLOGICAL EFFECTS, ACUTE EFFECTS, OIL DISCHARGES,
1612 NORTH SEA, LIABILITY, REGULATIONS, OFFSHORE DEVELOPMENT, NORWAY,
1616 NORTH SEA, LIABILITY, INTERNATIONAL CONVENTIONS, EUROPE, POLLUTION CONTROL, REGULATIONS, OFFSHORE DEVELOPMENT,
1007 NORWAY, NORTH SEA, OIL SPILLS, *EKOFISK BLOWOUT, SPILL CLEANUP,
1011 NORWAY, NORTH SEA, MONITORING, OIL SPILLS, *EKOFISK BLOWOUT, SPILL CLEANUP,
1147 NORWAY, NORTH SEA, ENVIRONMENTAL PROTECTION, ECONOMICS, SPILL CLEANUP, OFFSHORE DEVELOPMENT, SAFETY,
1612 NORWAY, NORTH SEA, LIABILITY, REGULATIONS, OFFSHORE DEVELOPMENT,
1057 NORWEGIAN SEA, NORTH SEA, MONITORING, BALTIC SEA, PETROLEUM PRODUCTS,
1047 OCEANS, MONITORING, ENVIRONMENTAL EFFECTS, ALASKA/GULF OF, *CIRCULATION PATTERNS, OCS, OFFSHORE DEVELOPMENT,
1075 OCEANS, DETECTION, DESIGN-ENGINEERING, REMOTE SENSING, OIL SLICKS,
1079 OCEANS, DETECTION, REMOTE SENSING, OIL SLICKS, *LASERS,
1083 OCEANS, HYDROCARBONS, FATE, SAMPLING,
1108 OCEANS, CONTAMINATION, CHEMICAL ANALYSIS, SEDIMENTS, PORTS, PETROLEUM PRODUCTS, USSR,
1164 OCEANS, SPILL CLEANUP,
1201 OCEANS, HARBORS, OIL DISCHARGES, SHIPS, *MERCHANT SHIPS,
1406 OCEANS, FOOD WEB, CONTAMINATION, BIOLOGICAL EFFECTS, PETROLEUM PRODUCTS, PHYTOPLANKTON,
1438 OCEANS, FATE, DRIFT, OIL SLICKS, *WAVE DAMPING, *WIND WAVE TUNNEL,
1446 OCEANS, ENVIRONMENTAL EFFECTS, CONTAMINATION, WATER QUALITY, OFFSHORE EXPLORATION,
1450 OCEANS, POLLUTION PREVENTION,
1458 OCEANS, MARINE ORGANISMS, HYDROCARBONS,
1587 OCEANS, MODELS, MARINE ORGANISMS, FATE, ENVIRONMENTAL EFFECTS, DISPERSIONS, SPILL CONTAINMENT,
1599 OCEANS, MODELS, FATE, OIL SPILLS, *COMPUTER PROGRAMMING,
1017 OCS, MEXICO/GULF OF, OIL SPILLS, OFFSHORE DRILLING,
1031 OCS, MONITORING, FATE, CONTAMINANTS, BEAUFORT SEA, BASELINE STUDIES, *OCEAN CURRENTS, OFFSHORE DEVELOPMENT,
1040 OCS, MONITORING, HYDROCARBONS, DISTRIBUTION, BERING SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT, *NATURALLY-OCCURRING HYDROCARBONS,
1047 OCS, OCEANS, MONITORING, ENVIRONMENTAL EFFECTS, ALASKA/GULF OF, *CIRCULATION PATTERNS,

OFFSHORE DEVELOPMENT,

1062 OCS, MONITORING, HYDROCARBONS, FATE, DISTRIBUTION, BASELINE STUDIES, ALASKA,

1072 OCS, FATE, ENVIRONMENTAL EFFECTS, CONTINGENCY PLANNING, ALASKA, REMOTE SENSING, OFFSHORE DEVELOPMENT, OIL SPILLS,

1078 OCS, ESTUARIES, DISPERSIONS, REMOTE SENSING, WASTEWATERS, *CURRENT CIRCULATION,

1085 OCS, MISSISSIPPI, HYDROCARBONS, ESTUARIES, ALABAMA, SAMPLING, SEDIMENTS, OIL SPILLS, TOXICITY,

1099 OCS, MEXICO/GULF OF, HYDROCARBONS, DISTRIBUTION, CHEMICAL ANALYSIS, BENTHOS, TEXAS,

1207 OCS, ECONOMICS, ALASKA/GULF OF, OIL TRANSPORT, OIL SPILLS, STORAGE, TANKERS, PIPELINES, OIL TANKS, *RISK ANALYSIS,

1332 OCS, HEALTH HAZARDS, OFFSHORE DRILLING, OIL TRANSPORT, POLLUTION PREVENTION, OIL WELLS, SAFETY,

1387 OCS, MOLLUSKS, HABITAT, BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA/GULF OF, OIL SPILLS, OFFSHORE DEVELOPMENT, *CLAMS,

1478 OCS, EIS, BIOLOGICAL EFFECTS, ATLANTIC OCEAN, OFFSHORE PRODUCTION, *GEORGES BANK,

1491 OCS, MONITORING, ENVIRONMENTAL EFFECTS, BENTHOS, BASELINE STUDIES, ALASKA, SEDIMENTS, OFFSHORE DEVELOPMENT,

1492 OCS, HABITAT, FISHERIES, FISH, BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT, *PACIFIC HERRING,

1493 OCS, ENVIRONMENTAL EFFECTS, ECOSYSTEMS, BENTHOS, OFFSHORE DEVELOPMENT, PLANKTON,

1495 OCS, MARINE MAMMALS, DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BEAUFORT SEA, OFFSHORE DEVELOPMENT, *SEALS, *TROPHIC STRUCTURE,

1497 OCS, MONITORING, FISH, ENVIRONMENTAL EFFECTS, BERING SEA, BEAUFORT SEA, BASELINE STUDIES, ALASKA/GULF OF, OFFSHORE DEVELOPMENT, *FISH DISEASES,

1510 OCS, CALIFORNIA, OIL-GAS LEASING, OFFSHORE DEVELOPMENT, ONSHORE IMPACTS, POLLUTION CONTROL,

1514 OCS, ENVIRONMENTAL EFFECTS, EIS, CALIFORNIA COAST, OIL-GAS LEASING, OFFSHORE DEVELOPMENT,

1515 OCS, ENVIRONMENTAL EFFECTS, ATLANTIC COAST, OFFSHORE DEVELOPMENT, OIL INDUSTRY, OIL WELLS,

1518 OCS, HYDROCARBONS, ENVIRONMENTAL EFFECTS, BLM, OFFSHORE DEVELOPMENT, *TRACE METALS,

1520 OCS, ENVIRONMENTAL EFFECTS, ALASKA, OFFSHORE DEVELOPMENT, OIL SPILLS, *GEOLOGY, *HYDROLOGY, *YUKON DELTA,

1522 OCS, MARSHES, LOUISIANA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OIL SPILLS, PIPELINES, *LAFOURCHE PARISH,

1533 OCS, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, BIRDS, BASELINE STUDIES, ALASKA, OFFSHORE DEVELOPMENT,

1534 OCS, ENVIRONMENTAL EFFECTS, BASELINE STUDIES, ALASKA, OFFSHORE DEVELOPMENT,

1539 OCS, ENVIRONMENTAL EFFECTS, ATLANTIC COAST, OIL SPILLS, OFFSHORE DEVELOPMENT, *RISK ANALYSIS,

1542 OCS, HABITAT, BIOLOGICAL EFFECTS, OFFSHORE DEVELOPMENT, ONSHORE IMPACTS, SPILL CLEANUP, POLLUTION PREVENTION,

1545 OCS, MICROORGANISMS, HYDROCARBONS, BIODEGRADATION, BEAUFORT SEA, BASELINE STUDIES, OFFSHORE DEVELOPMENT,

1546 OCS, MICROORGANISMS, HYDROCARBONS, BIODEGRADATION, BASELINE STUDIES, ALASKA/GULF OF, OFFSHORE DEVELOPMENT,

1590 OCS, MODELS, FATE, BASELINE STUDIES, ALASKA, *CIRCULATION, OIL SPILLS, *TRAJECTORY ANALYSIS,

1591 OCS, FATE, BASELINE STUDIES, ALASKA/GULF OF, OFFSHORE DEVELOPMENT, OIL SPILLS, *OCEAN CIRCULATION, *FLOW TRAJECTORIES,

1596 OCS, FATE, EIS, ATLANTIC COAST, OIL TRANSPORT, *SUSPENDED MATTER,

1597 OCS, FATE, CONTAMINANTS, BASELINE STUDIES, ALASKA, *OCEAN CIRCULATION, OFFSHORE DEVELOPMENT,

1031 OFFSHORE DEVELOPMENT, OCS, MONITORING, FATE, CONTAMINANTS, BEAUFORT SEA, BASELINE STUDIES, *OCEAN CURRENTS,

1038 OFFSHORE DEVELOPMENT, MONITORING, ESTUARIES, ENVIRONMENTAL EFFECTS, COASTS, BASELINE STUDIES, ALASKA, *STREAMFLOW, OIL SPILLS,

1040 OFFSHORE DEVELOPMENT, OCS, MONITORING, HYDROCARBONS, DISTRIBUTION, BERING SEA, BASELINE STUDIES, *NATURALLY-OCCURRING HYDROCARBONS,

1043 OFFSHORE DEVELOPMENT, NORTH SEA, MONITORING, MARINE ORGANISMS, BASELINE STUDIES, *CELTIC SEA,

1047 OFFSHORE DEVELOPMENT, OCS, OCEANS, MONITORING, ENVIRONMENTAL EFFECTS, ALASKA/GULF OF, *CIRCULATION PATTERNS,

1059 OFFSHORE DEVELOPMENT, MONITORING, FATE, CONTAMINANTS, COASTS, BASELINE STUDIES, ALASKA, *WIND CONDITIONS,

1060 OFFSHORE DEVELOPMENT, MONITORING, FATE, CONTAMINANTS, BASELINE STUDIES, ALASKA/GULF OF, *OCEAN CURRENTS,

1061 OFFSHORE DEVELOPMENT, MONITORING, ENVIRONMENTAL EFFECTS, BERING SEA, BEAUFORT SEA, BASELINE STUDIES, ALASKA/GULF OF, *MARINE CLIMATOLOGY,

1072 OFFSHORE DEVELOPMENT, OCS, FATE, ENVIRONMENTAL EFFECTS, CONTINGENCY PLANNING, ALASKA, REMOTE SENSING, OIL SPILLS,

1147 OFFSHORE DEVELOPMENT, NORWAY, NORTH SEA, ENVIRONMENTAL PROTECTION, ECONOMICS, SPILL CLEANUP, SAFETY,

1162 OFFSHORE DEVELOPMENT, NORTH SEA, OIL-WATER SEPARATION,

1222 OFFSHORE DEVELOPMENT, MODELS, ENVIRONMENTAL EFFECTS, COST ANALYSIS, OIL TRANSFER, SOCIO-ECONOMIC EFFECTS, SPREADING,

1333 OFFSHORE DEVELOPMENT, NORTH SEA, POLLUTION PREVENTION, OIL SPILLS, *SUPPORT SYSTEMS,

1347 OFFSHORE DEVELOPMENT, INFORMATION SYSTEMS, DESIGN-ENGINEERING, OIL SPILLS, REGULATIONS, SAFETY, *OCEAN TECHNOLOGY,

1350 OFFSHORE DEVELOPMENT, FOOD WEB, BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA/GULF OF, OIL SPILLS, *PRIMARY PRODUCTION,

1387 OFFSHORE DEVELOPMENT, OCS, MOLLUSKS, HABITAT, BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA/GULF OF, OIL SPILLS, *CLAMS,

1419 OFFSHORE DEVELOPMENT, FISHERIES, FISH, CRUDE OIL, ALASKA/GULF OF, ACUTE EFFECTS, TOXICITY, *PACIFIC HERRING,

1447 OFFSHORE DEVELOPMENT, MODELS, ALASKA, ONSHORE IMPACTS,

1448 OFFSHORE DEVELOPMENT, MICROORGANISMS, ENVIRONMENTAL EFFECTS, CRUDE OIL, SEDIMENTS, RELEASE, *TRACE METALS,

1467 OFFSHORE DEVELOPMENT, MONITORING, ICE, FOOD WEB, BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, PHYTOPLANKTON,

1469 OFFSHORE DEVELOPMENT, MONITORING, FISHERIES, ESTUARIES, DISTRIBUTION, BIOLOGICAL EFFECTS, BEAUFORT SEA, BASELINE STUDIES,

1471 OFFSHORE DEVELOPMENT, MONITORING, MARINE ORGANISMS, HABITAT, COASTS, BIOLOGICAL EFFECTS, BEAUFORT SEA, BASELINE STUDIES,

1472 OFFSHORE DEVELOPMENT, MONITORING, MARINE MAMMALS, BIOLOGICAL EFFECTS, BERING SEA, BEAUFORT SEA, *BEARDED AND RINGED SEALS, *ECOLOGY,

1473 OFFSHORE DEVELOPMENT, MARINE MAMMALS, DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, *SPOTTED SEAL,

1474 OFFSHORE DEVELOPMENT, MARINE MAMMALS, ICE, HABITAT, DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BEAUFORT SEA, BASELINE STUDIES,

1475 OFFSHORE DEVELOPMENT, MARINE MAMMALS, DISTRIBUTION, BIOLOGICAL EFFECTS, ALASKA/GULF OF, *SEA LIONS, *ECOLOGY, *TROPHIC STRUCTURE,

1477 OFFSHORE DEVELOPMENT, DISTRIBUTION, BIOLOGICAL EFFECTS, BENTHOS, BEAUFORT SEA, BASELINE STUDIES,

1479 OFFSHORE DEVELOPMENT, DISTRIBUTION, BERING SEA, BEAUFORT SEA, BASELINE STUDIES, ZOOPLANKTON, *MICRONEKTON,

1480 OFFSHORE DEVELOPMENT, MONITORING, DISTRIBUTION, BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA/GULF OF, ZOOPLANKTON,

1481 OFFSHORE DEVELOPMENT, MONITORING, DISTRIBUTION, BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA/GULF OF, PLANKTON, *ICHTHYOPLANKTON,

1483 OFFSHORE DEVELOPMENT, MARINE MAMMALS, BERING SEA, BASELINE STUDIES, TOXICITY, *MORTALITY,

1484 OFFSHORE DEVELOPMENT, DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BENTHOS, ALASKA/GULF OF, *PRODUCTIVITY,

1485 OFFSHORE DEVELOPMENT, MONITORING, DISTRIBUTION, BIOLOGICAL EFFECTS, BENTHOS, BASELINE STUDIES, ALASKA/GULF OF, *PRODUCTIVITY, STATISTICAL ANALYSIS,

1487 OFFSHORE DEVELOPMENT, MARINE MAMMALS, DISTRIBUTION, BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA/GULF OF,

1488 OFFSHORE DEVELOPMENT, MARINE MAMMALS, DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BEAUFORT SEA, BASELINE STUDIES, OIL-GAS LEASING, OIL SPILLS,

1489 OFFSHORE DEVELOPMENT, MARINE MAMMALS, DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, *WHALES,

1490 OFFSHORE DEVELOPMENT, MARINE MAMMALS, DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, OIL-GAS LEASING,

1491 OFFSHORE DEVELOPMENT, OCS, MONITORING, ENVIRONMENTAL EFFECTS, BENTHOS, BASELINE STUDIES, ALASKA, SEDIMENTS,

1492 OFFSHORE DEVELOPMENT, OCS, HABITAT, FISHERIES, FISH, BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, *PACIFIC HERRING,

1493 OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ECOSYSTEMS, BENTHOS, PLANKTON,

1494 OFFSHORE DEVELOPMENT, MONITORING, BIOLOGICAL EFFECTS, BASELINE STUDIES, PHYTOPLANKTON, *PRIMARY PRODUCTION,

1495 OFFSHORE DEVELOPMENT, OCS, MARINE MAMMALS, DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BEAUFORT SEA, *SEALS, *TROPHIC STRUCTURE,

1497 OFFSHORE DEVELOPMENT, OCS, MONITORING, FISH, ENVIRONMENTAL EFFECTS, BERING SEA, BEAUFORT SEA, BASELINE STUDIES, ALASKA/GULF OF, *FISH DISEASES,

1498 OFFSHORE DEVELOPMENT, MONITORING, MARINE ORGANISMS, DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES,

1499 OFFSHORE DEVELOPMENT, FISHERIES, FISH, BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA/GULF OF, *SHELLFISH, *DEMERSAL RESOURCES,

1500 OFFSHORE DEVELOPMENT, MARINE MAMMALS, FOOD WEB, CONTAMINANTS, BIOLOGICAL EFFECTS, ALASKA/GULF OF, *ECOLOGY, *HARBOR SEAL,

1501 OFFSHORE DEVELOPMENT, MARINE MAMMALS, DISTRIBUTION, BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA, *SEA OTTERS,

1502 OFFSHORE DEVELOPMENT, MARINE MAMMALS, HABITAT, DISTRIBUTION, CONTAMINATION, ALASKA, *SEA OTTERS,

1503 OFFSHORE DEVELOPMENT, FOOD WEB, FISH, BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES, ALASKA/GULF OF,

1508 OFFSHORE DEVELOPMENT, FRANCE, FISHERIES, ECONOMIC EFFECTS, CONTAMINATION,

1510 OFFSHORE DEVELOPMENT, OCS, CALIFORNIA, OIL-GAS LEASING, ONSHORE IMPACTS, POLLUTION CONTROL,

1513 OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, PLATFORMS, REGULATIONS, OIL INDUSTRY,
1514 OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, EIS, CALIFORNIA COAST, OIL-GAS LEASING,
1515 OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ATLANTIC COAST, OIL INDUSTRY, OIL WELLS,
1517 OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, COASTS, RESOURCE MANAGEMENT, *CONFERENCES, *COASTAL IMPACTS,
1518 OFFSHORE DEVELOPMENT, OCS, HYDROCARBONS, ENVIRONMENTAL EFFECTS, BLM, *TRACE METALS,
1519 OFFSHORE DEVELOPMENT, LEGISLATION, CALIFORNIA COAST, ONSHORE IMPACTS,
1520 OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ALASKA, OIL SPILLS, *GEOLOGY, *HYDROLOGY, *YUKON DELTA,
1522 OFFSHORE DEVELOPMENT, OCS, MARSHES, LOUISIANA, ENVIRONMENTAL EFFECTS, OIL SPILLS, PIPELINES, *LAFOURCHE PARISH,
1529 OFFSHORE DEVELOPMENT, LIABILITY, INSURANCE, REGULATIONS, SHIPS, PORTS,
1533 OFFSHORE DEVELOPMENT, OCS, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, BIRDS, BASELINE STUDIES, ALASKA,
1534 OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, BASELINE STUDIES, ALASKA,
1535 OFFSHORE DEVELOPMENT, NEW JERSEY, DELAWARE, COASTS, ONSHORE IMPACTS, PORTS, SOCIO-ECONOMIC EFFECTS,
1539 OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ATLANTIC COAST, OIL SPILLS, *RISK ANALYSIS,
1541 OFFSHORE DEVELOPMENT, ECONOMIC EFFECTS, ALASKA, SOCIAL EFFECTS,
1542 OFFSHORE DEVELOPMENT, OCS, HABITAT, BIOLOGICAL EFFECTS, ONSHORE IMPACTS, SPILL CLEANUP, POLLUTION PREVENTION,
1545 OFFSHORE DEVELOPMENT, OCS, MICROORGANISMS, HYDROCARBONS, BIODEGRADATION, BEAUFORT SEA, BASELINE STUDIES,
1546 OFFSHORE DEVELOPMENT, OCS, MICROORGANISMS, HYDROCARBONS, BIODEGRADATION, BASELINE STUDIES, ALASKA/GULF OF,
1591 OFFSHORE DEVELOPMENT, OCS, FATE, BASELINE STUDIES, ALASKA/GULF OF, OIL SPILLS, *OCEAN CIRCULATION, *FLOW TRAJECTORIES,
1593 OFFSHORE DEVELOPMENT, FOOD WEB, FISHERIES, CONTAMINATION, BERING SEA, *CIRCULATION, *BRISTOL BAY,
1597 OFFSHORE DEVELOPMENT, OCS, FATE, CONTAMINANTS, BASELINE STUDIES, ALASKA, *OCEAN CIRCULATION,
1606 OFFSHORE DEVELOPMENT, LEGISLATION, ENVIRONMENTAL PROTECTION, US, OIL-GAS LEASING, ONSHORE IMPACTS, *OCS LANDS ACT AMENDMENTS,
1612 OFFSHORE DEVELOPMENT, NORWAY, NORTH SEA, LIABILITY, REGULATIONS,
1616 OFFSHORE DEVELOPMENT, NORTH SEA, LIABILITY, INTERNATIONAL CONVENTIONS, EUROPE, POLLUTION CONTROL, REGULATIONS,
1626 OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, BIBLIOGRAPHIES, PIPELINES, OIL TRANSPORT,
1630 OFFSHORE DEVELOPMENT, FISH, DISTRIBUTION, BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, BEAUFORT SEA,
1005 OFFSHORE DRILLING, NORTH SEA, OIL SPILLS, SPILL CONTAINMENT, *WELL BLOWOUT,
1009 OFFSHORE DRILLING, NORTH SEA, OIL SPILLS, SPILL CONTAINMENT, *EKOFISK WELL BLOWOUT,
1017 OFFSHORE DRILLING, OCS, MEXICO/GULF OF, OIL SPILLS,
1050 OFFSHORE DRILLING, MONITORING, DESIGN-ENGINEERING, PATENT, *OIL-IN-WATER,
1062 OFFSHORE DRILLING, MICROORGANISMS, DISTRIBUTION, BIOLOGICAL EFFECTS, ATLANTIC COAST, SAMPLING, SEAWATER, SEDIMENTS,
1328 OFFSHORE DRILLING, BLOWOUT PREVENTION, *RISERLESS DRILLING METHOD,
1329 OFFSHORE DRILLING, NORTH SEA, FATE, ENVIRONMENTAL EFFECTS, CRUDE OIL, POLLUTION PREVENTION, OIL TRANSPORT, SPILL CLEANUP,
1332 OFFSHORE DRILLING, OCS, HEALTH HAZARDS, OIL TRANSPORT, POLLUTION PREVENTION, OIL WELLS, SAFETY,
1476 OFFSHORE DRILLING, FOOD WEB, BIOLOGICAL EFFECTS, BENTHOS, BEAUFORT SEA, OIL SPILLS,
1496 OFFSHORE DRILLING, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, DISPOSAL, *DRILLING WASTES,
1507 OFFSHORE DRILLING, ONSHORE IMPACTS, SOCIO-ECONOMIC EFFECTS, PRODUCTION,
1523 OFFSHORE DRILLING, MARINE ORGANISMS, ICE, ENVIRONMENTAL EFFECTS, BEAUFORT SEA, BASELINE STUDIES, ARCTIC, SPILL CLEANUP,
1530 OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS, ONSHORE IMPACTS,
1531 OFFSHORE DRILLING, MOVEMENT, MARINE MAMMALS, FISH, ENVIRONMENTAL EFFECTS, BIRDS, BEAUFORT SEA, OIL SPILLS, SPREADING,
1536 OFFSHORE DRILLING, CALIFORNIA COAST, ONSHORE IMPACTS, POLLUTION PREVENTION, *LAND USE CONFLICTS,
1563 OFFSHORE DRILLING, MICROORGANISMS, CRUDE OIL, BIODEGRADATION, ATLANTIC COAST, SAMPLING, *OIL DEVELOPMENT SITES,
1582 OFFSHORE DRILLING, NORTH SEA, FATE, EVAPORATION, DISPERSIONS, OIL SPILLS, SPILL RECOVERY, *EKOFISK WELL BLOWOUT,
1585 OFFSHORE DRILLING, MOVEMENT, MODELS, FATE, CONTAMINANTS, PRUDHOE BAY, *OCEAN CIRCULATION, *POLLUTANT TRANSPORT,
1588 OFFSHORE DRILLING, MOVEMENT, BASELINE STUDIES, ALASKA/GULF OF, OIL SPILLS, *OCEAN CIRCULATION,
1446 OFFSHORE EXPLORATION, OCEANS, ENVIRONMENTAL EFFECTS, CONTAMINATION, WATER QUALITY,
1091 OFFSHORE PRODUCTION, CHEMICAL ANALYSIS, SEDIMENTS,
1468 OFFSHORE PRODUCTION, NATURAL SEEPAGE, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, API,

PLATFORMS,
1478 OFFSHORE PRODUCTION, OCS, EIS, BIOLOGICAL EFFECTS, ATLANTIC OCEAN, *GEORGES BANK,
1486 OFFSHORE PRODUCTION, BIOLOGICAL EFFECTS, BERING SEA, BENTHOS, BASELINE STUDIES, OIL TRANSPORT, OIL SPILLS,
1521 OFFSHORE PRODUCTION, ENVIRONMENTAL EFFECTS, DEVELOPMENT, US, OIL SHALE,
1526 OFFSHORE PRODUCTION, HYDROCARBONS, FATE, EXTRACTION, ENVIRONMENTAL EFFECTS, COASTS, *PRODUCED WATERS,
1528 OFFSHORE PRODUCTION, ENVIRONMENTAL PROTECTION, ECONOMICS, SAFETY, POLLUTION PREVENTION,
1213 OHIO, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, WATER QUALITY, OIL SPILLS, *IRONTON MINE,
1036 OIL DISCHARGES, MONITORING, BILGES, BALLAST, SHIPS,
1048 OIL DISCHARGES, MONITORING, GOVERNMENT AGENCIES, ENVIRONMENTAL PROTECTION, OIL INDUSTRY,
1201 OIL DISCHARGES, OCEANS, HARBORS, SHIPS, *MERCHANT SHIPS,
1203 OIL DISCHARGES, MARINE ORGANISMS, FISHERIES, FATE, BIOLOGICAL EFFECTS, OIL TRANSPORT, SOURCES, PACIFIC OCEAN,
1206 OIL DISCHARGES, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, OIL TRANSFER, PORTS, UK, *MILFORD HAVEN,
1219 OIL DISCHARGES, ENVIRONMENTAL EFFECTS, ECONOMICS, TANKERS, OIL TRANSPORT, OIL SPILLS, *SUPERTANKERS,
1324 OIL DISCHARGES, LEGISLATION, DESIGN-ENGINEERING, CONTINGENCY PLANNING, US, SPILL CLEANUP, SURVEILLANCE,
1330 OIL DISCHARGES, MONITORING, IMCO, TANKERS, POLLUTION CONTROL, REGULATIONS, *BAILEY MONITOR PROGRAM,
1331 OIL DISCHARGES, EPA, DRILLING, CONTINGENCY PLANNING, POLLUTION PREVENTION, REGULATIONS, *NAVIGABLE WATERS,
1449 OIL DISCHARGES, FATE, DISPERSANTS, CONTAMINATION, BIOLOGICAL EFFECTS, SHIPS, TANKERS,
1512 OIL DISCHARGES, ENVIRONMENTAL EFFECTS, EIS, PORTS, REGULATIONS, SAFETY, *DEEPWATER PORT,
1595 OIL DISCHARGES, NORTH SEA, MARINE ORGANISMS, FATE, CHRONIC EFFECTS, BIOLOGICAL EFFECTS, ACUTE EFFECTS,
1608 OIL DISCHARGES, LIABILITY, LEGISLATION, COMPENSATION, US, STATE GOVERNMENTS, *NAVIGABLE WATERS,
1611 OIL DISCHARGES, LIABILITY, LEGISLATION, FOREIGN GOVERNMENTS, US, POLLUTION PREVENTION,
1617 OIL DISCHARGES, MONITORING, INTERNATIONAL CONVENTIONS, IMCO, TANKERS, POLLUTION PREVENTION, OIL-WATER SEPARATION,
1619 OIL DISCHARGES, LAW ENFORCEMENT, INTERNATIONAL CONVENTIONS, SHIPS, POLLUTION CONTROL, OIL-WATER SEPARATION,
1470 OIL FIELDS, ENVIRONMENTAL PROTECTION, DEVELOPMENT, COASTS, BIRDS, ALASKA, PRUDHOE BAY, *TUNDRA WETLANDS,
1488 OIL-GAS LEASING, OFFSHORE DEVELOPMENT, MARINE MAMMALS, DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BEAUFORT SEA, BASELINE STUDIES, OIL SPILLS,
1490 OIL-GAS LEASING, OFFSHORE DEVELOPMENT, MARINE MAMMALS, DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES,
1510 OIL-GAS LEASING, OFFSHORE DEVELOPMENT, OCS, CALIFORNIA, ONSHORE IMPACTS, POLLUTION CONTROL,
1514 OIL-GAS LEASING, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, EIS, CALIFORNIA COAST,
1524 OIL-GAS LEASING, FISHERIES, ENVIRONMENTAL EFFECTS, EIS, BLM, ATLANTIC OCEAN, ARGO MERCHANT SPILL, *GEORGES BANK,
1606 OIL-GAS LEASING, OFFSHORE DEVELOPMENT, LEGISLATION, ENVIRONMENTAL PROTECTION, US, ONSHORE IMPACTS, *OCS LANDS ACT AMENDMENTS,
1048 OIL INDUSTRY, OIL DISCHARGES, MONITORING, GOVERNMENT AGENCIES, ENVIRONMENTAL PROTECTION,
1096 OIL INDUSTRY, ANALYTICAL TECHNIQUES, WATER QUALITY, POLLUTION CONTROL, WASTEWATERS, SAMPLING, *ON-LINE INSTRUMENTATION,
1238 OIL INDUSTRY, MANUALS, WASTEWATER TREATMENT, PETROCHEMICALS, REFINERIES, POLLUTION CONTROL,
1288 OIL INDUSTRY, INDUSTRIES, DISPOSAL, WASTEWATERS, SOLID WASTES,
1335 OIL INDUSTRY, MONITORING, LEGISLATION, ENVIRONMENTAL EFFECTS, UK, OIL SPILLS, WASTEWATERS,
1342 OIL INDUSTRY, ENVIRONMENTAL EFFECTS, POLLUTION PREVENTION, REFINING, OIL TRANSPORT, OIL SPILLS,
1442 OIL INDUSTRY, HYDROCARBONS, DISPERSANTS, CONTAMINATION, *AQUATIC POLLUTION,
1509 OIL INDUSTRY, ENVIRONMENTAL EFFECTS, DEVELOPMENT, REFINERIES, PETROCHEMICALS,
1513 OIL INDUSTRY, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, PLATFORMS, REGULATIONS,
1515 OIL INDUSTRY, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ATLANTIC COAST, OIL WELLS,
1525 OIL INDUSTRY, ENVIRONMENTAL EFFECTS, SOCIO-ECONOMIC EFFECTS, PRODUCTION, SCOTLAND, *SULLOM VOE,
1623 OIL INDUSTRY, HEALTH HAZARDS, GUIDELINES, STORAGE, SAFETY, *BULK PETROLEUM PLANTS,
1625 OIL INDUSTRY, MARINE ORGANISMS, HYDROCARBONS, CHEMICAL ANALYSIS, BIBLIOGRAPHIES, OIL SPILLS, SOURCE IDENTIFICATION,
1521 OIL SHALE, OFFSHORE PRODUCTION, ENVIRONMENTAL EFFECTS, DEVELOPMENT, US,
1527 OIL SHALE, EXTRACTION, EIS, DISPOSAL, COLORADO, SOLID WASTES, RESTORATION,

1537 OIL SHALE, ENVIRONMENTAL EFFECTS, ECONOMICS, DEVELOPMENT, PRODUCTION,
1538 OIL SHALE, ENVIRONMENTAL EFFECTS, DEVELOPMENT, *RESEARCH PROGRAMS,
1543 OIL SHALE, ENVIRONMENTAL EFFECTS, ECONOMICS, DEVELOPMENT,
1015 OIL SLICKS, ENGLAND, CONTAMINATION, COASTS, BIRDS, RESTORATION,
1033 OIL SLICKS, MONITORING, BALLAST, POLLUTION PREVENTION, TANKERS, *OIL-WATER INTERFACE,
1042 OIL SLICKS, MONITORING, DESIGN-ENGINEERING, BALLAST, TANKERS, PATENT,
1045 OIL SLICKS, MONITORING, DESIGN-ENGINEERING, *SPILL TRACKING BUOY,
1069 OIL SLICKS, MONITORING, DESIGN-ENGINEERING, PATENT, *LIGHT SENSOR,
1071 OIL SLICKS, DETECTION, REMOTE SENSING, USGS, *LANDSAT IMAGERY,
1074 OIL SLICKS, DESIGN-ENGINEERING, REMOTE SENSING, SURVEILLANCE,
1075 OIL SLICKS, OCEANS, DETECTION, DESIGN-ENGINEERING, REMOTE SENSING,
1076 OIL SLICKS, REMOTE SENSING, SEAWATER, *LIDAR ENERGETICS,
1077 OIL SLICKS, MOVEMENT, MONITORING, REMOTE SENSING, *SATELLITE-AIRCRAFT-DROGUE STUDIES,
1079 OIL SLICKS, OCEANS, DETECTION, REMOTE SENSING, *LASERS,
1081 OIL SLICKS, DESIGN-ENGINEERING, SAMPLING, SURFACTANTS, PATENT,
1093 OIL SLICKS, HYDROCARBONS, CHEMICAL ANALYSIS, SWEDEN,
1140 OIL SLICKS, DESIGN-ENGINEERING, BOOMS, SPILL CLEANUP, SKIMMERS, PATENT,
1157 OIL SLICKS, SPILL RECOVERY, POLLUTION PREVENTION, USN, *GELATION, *AMINE CARBAMATES,
1175 OIL SLICKS, MICROORGANISMS, BIODEGRADATION, SPILL CLEANUP, PATENT, *NUTRIENT PARTICLES,
1283 OIL SLICKS, ABSORPTION, WASTEWATER TREATMENT, SPILL RECOVERY, PATENT, *POLYURETHANE,
1437 OIL SLICKS, PHYSICAL EFFECTS, *REAERATION RATES,
1438 OIL SLICKS, OCEANS, FATE, DRIFT, *WAVE DAMPING, *WIND WAVE TUNNEL,
1465 OIL SLICKS, BIOLOGICAL EFFECTS, ANIMALS, PHYSICAL EFFECTS, PLANTS, *OXYGEN EXCHANGE, *TEMPERATURE, *LIGHT REDUCTION, *ROCK POOLS,
1551 OIL SLICKS, DESIGN-ENGINEERING, BIODEGRADATION, BACTERIA, SPILL CLEANUP, PATENT,
1566 OIL SLICKS, NEUSTON, CASPIAN SEA, BLACK SEA, BIODEGRADATION, BACTERIA, ALASKA/GULF OF, *AZOV SEA,
1570 OIL SLICKS, DRIFT, SPREADING, PHYSICAL EFFECTS, WEATHERING,
1577 OIL SLICKS, HYDROCARBONS, DECOMPOSITION, *PHOTOCHEMICAL DEGRADATION,
1586 OIL SLICKS, MOVEMENT, MODELS, CANADA,
1592 OIL SLICKS, MOVEMENT, COASTS, BEAUFORT SEA, *IMPACT LOCATIONS,
1624 OIL SLICKS, ICE, BIODEGRADATION, BIBLIOGRAPHIES, ARCTIC, CONTAINMENT, RECOVERY, OIL TRANSFER, STORAGE, SPILL DISPOSAL,
1005 OIL SPILLS, OFFSHORE DRILLING, NORTH SEA, SPILL CONTAINMENT, *WELL BLOWOUT,
1007 OIL SPILLS, NORWAY, NORTH SEA, *EKOFISK BLOWOUT, SPILL CLEANUP,
1108 OIL SPILLS, NORTH SEA, BEACHES, SCOTLAND,
1009 OIL SPILLS, OFFSHORE DRILLING, NORTH SEA, SPILL CONTAINMENT, *EKOFISK WELL BLOWOUT,
1011 OIL SPILLS, NORWAY, NORTH SEA, MONITORING, *EKOFISK BLOWOUT, SPILL CLEANUP,
1014 OIL SPILLS, ARGO MERCHANT SPILL, TANKERS, *LIBERIAN REGISTRY,
1017 OIL SPILLS, OFFSHORE DRILLING, OCS, MEXICO/GULF OF,
1018 OIL SPILLS, ISRAEL, CONTAMINATION, SPILL CLEANUP, OIL TRANSFER, PORTS, SHORELINES, *EILAT OIL TERMINAL,
1020 OIL SPILLS, MANUALS, INFORMATION SYSTEMS,
1021 OIL SPILLS, JAPAN, ENVIRONMENTAL DETERIORATION, STATISTICS, *SETO INLAND SEA,
1023 OIL SPILLS, MOVEMENT, JAPAN, FUEL OIL, ENVIRONMENTAL EFFECTS, SPILL CLEANUP, *INLAND SEA,
1024 OIL SPILLS, MASSACHUSETTS, FUEL OIL, FISHERIES, CONTAMINATION, *BUZZARDS BAY, *SHELLFISH RESOURCES,
1029 OIL SPILLS, BIOLOGICAL EFFECTS,
1030 OIL SPILLS, TANKERS, SHIPS, SOURCES,
1035 OIL SPILLS, NOAA, MONITORING, MOLLUSKS, ENVIRONMENTAL EFFECTS, BASELINE STUDIES, SEDIMENTS, PUGET SOUND,
1038 OIL SPILLS, OFFSHORE DEVELOPMENT, MONITORING, ESTUARIES, ENVIRONMENTAL EFFECTS, COASTS, BASELINE STUDIES, ALASKA, *STREAMFLOW,
1072 OIL SPILLS, OFFSHORE DEVELOPMENT, OCS, FATE, ENVIRONMENTAL EFFECTS, CONTINGENCY PLANNING, ALASKA, REMOTE SENSING,
1080 OIL SPILLS, MODELS, DETECTION, COASTS, REMOTE SENSING, POLLUTION PREVENTION, *LINEAR PROGRAMMING,
1085 OIL SPILLS, OCS, MISSISSIPPI, HYDROCARBONS, ESTUARIES, ALABAMA, SAMPLING, SEDIMENTS, TOXICITY,
1115 OIL SPILLS, MODELS, ENVIRONMENTAL EFFECTS, ECONOMICS, TANKERS, *OPTIMAL TANKER SIZE,
1124 OIL SPILLS, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, SPECTROSCOPY, SEAWATER,
1130 OIL SPILLS, CRUDE OIL, ANALYTICAL TECHNIQUES, CHROMATOGRAPHY, SPECTROMETRY, U.S.
1197 OIL SPILLS, BIRDS, RESTORATION, SOLVENTS,
1198 OIL SPILLS, CONTAMINATION, BIRDS, RESTORATION, TORREY CANYON, OLYMPIC GAMES SPILL,
1200 OIL SPILLS, LEGISLATION, TANKERS, POLLUTION PREVENTION, US,
1202 OIL SPILLS, LEGISLATION, OIL TRANSPORT, TANKERS, PUGET SOUND, WASHINGTON,
1207 OIL SPILLS, OCS, ECONOMICS, ALASKA/GULF OF, OIL TRANSPORT, STORAGE, TANKERS, PIPELINES, OIL TANKS, *RISK ANALYSIS,
1211 OIL SPILLS, KENTUCKY, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, WATER QUALITY, *CENTRAL ROCK MINE,
1212 OIL SPILLS, LOUISIANA, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, WATER QUALITY, *COTE BLANCHE MINE,
1130 OIL SPILLS, CRUDE OIL, ANALYTICAL TECHNIQUES, CHROMATOGRAPHY, SPECTROMETRY, *U.S. BUREAU OF MINES,

1213 OIL SPILLS, OHIO, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, WATER QUALITY, *IRONTON MINE,
1214 OIL SPILLS, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, WATER QUALITY, TEXAS, *KLEER MINE,
1215 OIL SPILLS, LOUISIANA, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, WATER QUALITY, *WEEKS ISLAND MINE,
1218 OIL SPILLS, ENVIRONMENTAL EFFECTS, ALASKA, OIL TRANSPORT, TANKERS, *VALDEZ NARROWS,
1219 OIL SPILLS, OIL DISCHARGES, ENVIRONMENTAL EFFECTS, ECONOMICS, TANKERS, OIL TRANSPORT, *SUPERTANKERS,
1223 OIL SPILLS, MODELS, LEAKAGE, FATE, EVAPORATION, OIL TRANSPORT, PIPELINES, SPREADING, *IGNITION HAZARDS,
1224 OIL SPILLS, ENVIRONMENTAL EFFECTS, ALASKA, OIL TRANSPORT, TANKERS, PORTS, *VALDEZ NARROWS,
1227 OIL SPILLS, LIABILITY, LEGISLATION, ENVIRONMENTAL EFFECTS, DEVELOPMENT, ALASKA, PIPELINES,
1321 OIL SPILLS, POLLUTION CONTROL, PERSONNEL TRAINING, *SPILL CONTROL SCHOOL,
1322 OIL SPILLS, LIABILITY, CONTINGENCY PLANNING, POLLUTION PREVENTION, *LEGAL RESPONSIBILITIES,
1327 OIL SPILLS, LIABILITY, COMPENSATION, POLLUTION PREVENTION, SPILL CLEANUP, *CONGRESSIONAL BILL,
1333 OIL SPILLS, OFFSHORE DEVELOPMENT, NORTH SEA, POLLUTION PREVENTION, *SUPPORT SYSTEMS,
1335 OIL SPILLS, OIL INDUSTRY, MONITORING, LEGISLATION, ENVIRONMENTAL EFFECTS, UK, WASTEWATERS,
1342 OIL SPILLS, OIL INDUSTRY, ENVIRONMENTAL EFFECTS, POLLUTION PREVENTION, REFINING, OIL TRANSPORT,
1346 OIL SPILLS, LAW ENFORCEMENT, HARBORS, POLLUTION CONTROL, SHIPS, UK, *MILFORD HAVEN,
1347 OIL SPILLS, OFFSHORE DEVELOPMENT, INFORMATION SYSTEMS, DESIGN-ENGINEERING, REGULATIONS, SAFETY, *OCEAN TECHNOLOGY,
1349 OIL SPILLS, FISH, ESTUARIES, DELAWARE RIVER, TOXICITY, *CORINTHOS SPILL,
1350 OIL SPILLS, OFFSHORE DEVELOPMENT, FOOD WEB, BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA/GULF OF, *PRIMARY PRODUCTION,
1354 OIL SPILLS, MICROORGANISMS, FUEL OIL, TOXICITY, YEASTS, *ULTRAVIOLET LIGHT EXPOSURE,
1355 OIL SPILLS, ENVIRONMENTAL EFFECTS, ATLANTIC COAST, SHORELINES, *WWII SPILLS,
135 OIL SPILLS, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, PORTS, WASTEWATERS, REFINERIES, UK, *MILFORD HAVEN,
1358 OIL SPILLS, MONITORING, BIOLOGICAL EFFECTS, WASTEWATERS, REFINERIES, PORTS, UK, *MILFORD HAVEN, *OIL POLLUTION RESEARCH UNIT,
1364 OIL SPILLS, ENVIRONMENTAL DETERIORATION, VEGETATION, WASHINGTON, *ALPINE MEADOW,
1365 OIL SPILLS, MARSHES, BIOLOGICAL EFFECTS, PLANTS, SAMPLING, *SPECIES REDUCTION,
1376 OIL SPILLS, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, ARCTIC, ALASKA, *PRUDHOE BAY,
1378 OIL SPILLS, METABOLISM, MARINE MAMMALS, BIOLOGICAL EFFECTS, ALASKA, *PHYSIOLOGY, *PINNIPEDS,
1386 OIL SPILLS, MOVEMENT, ENVIRONMENTAL EFFECTS, ATLANTIC COAST, WWII SPILLS, TANKERS,
1387 OIL SPILLS, OFFSHORE DEVELOPMENT, OCS, MOLLUSKS, HABITAT, BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA/GULF OF, *CLAMS,
1402 OIL SPILLS, METULA SPILL, MARSHES, MARINE ORGANISMS, BIOLOGICAL EFFECTS, TANKERS, PORTS, UK, *MILFORD HAVEN,
1407 OIL SPILLS, MARINE ORGANISMS, CHRONIC EFFECTS, BIOLOGICAL EFFECTS,
1424 OIL SPILLS, MOLLUSKS, INTERTIDAL ZONE, FUEL OIL, CHRONIC EFFECTS, ACUTE EFFECTS, TOXICITY, *HONG KONG,
1443 OIL SPILLS, POLLUTION PREVENTION, POLLUTION CONTROL,
1445 OIL SPILLS, CHESAPEAKE BAY, SHIPS, PORTS, POLLUTION CONTROL, *SYMPOSIUM,
1457 OIL SPILLS, MONITORING, DISPERSANTS, CONTAMINATION, REFINERIES, TOXICITY, *BOOK REVIEW,
1461 OIL SPILLS, ENVIRONMENTAL EFFECTS, BENTHOS, SEDIMENTATION, *ANIMAL-SEDIMENT RELATIONSHIPS,
1462 OIL SPILLS, MONITORING, FISHERIES, ENVIRONMENTAL EFFECTS, CHINA, PLANKTON, *HONG KONG,
1464 OIL SPILLS, ENVIRONMENTAL EFFECTS, COASTS, BASELINE STUDIES, *COASTAL IMPACTS,
1476 OIL SPILLS, OFFSHORE DRILLING, FOOD WEB, BIOLOGICAL EFFECTS, BENTHOS, BEAUFORT SEA,
1486 OIL SPILLS, OFFSHORE PRODUCTION, BIOLOGICAL EFFECTS, BERING SEA, BENTHOS, BASELINE STUDIES, OIL TRANSPORT,
1488 OIL SPILLS, OIL-GAS LEASING, OFFSHORE DEVELOPMENT, MARINE MAMMALS, DISTRIBUTION, BIOLOGICAL EFFECTS, BERING SEA, BEAUFORT SEA, BASELINE STUDIES,
1520 OIL SPILLS, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ALASKA, *GEOLOGY, *HYDROLOGY, *YUKON DELTA,
1522 OIL SPILLS, OFFSHORE DEVELOPMENT, OCS, MARSHES, LOUISIANA, ENVIRONMENTAL EFFECTS, PIPELINES, *LAFOURCHE PARISH,
1531 OIL SPILLS, OFFSHORE DRILLING, MOVEMENT, MARINE MAMMALS, FISH, ENVIRONMENTAL EFFECTS, BIRDS, BEAUFORT SEA, SPREADING,
1532 OIL SPILLS, FUELS, ENVIRONMENTAL EFFECTS, FOSSIL WATER QUALITY,
1539 OIL SPILLS, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ATLANTIC COAST, *RISK ANALYSIS,
1562 OIL SPILLS, FATE, EMULSIFICATION, DISPERSIONS, BIODEGRADATION, BACTERIA, WEATHERING,
1564 OIL SPILLS, BIODEGRADATION, BACTERIA, PETROLEUM PRODUCTS,
1572 OIL SPILLS, MODELS, HYDROCARBONS, EVAPORATION, CRUDE OIL, SOLUTION, TOXICITY,
1573 OIL SPILLS, ICE, BEHAVIOR, ARCTIC, ABSORPTION, SPREADING, SOLUBILITY, CLEANUP,

1574 OIL SPILLS, ICE, COASTS, ARCTIC OCEAN, ALASKA, *OIL-ICE INTERACTION,
1576 OIL SPILLS, MOVEMENT, SPREADING, *WAVE INTERACTION ANALYSIS,
1580 OIL SPILLS, NORTH SEA, MODELS, ENVIRONMENTAL EFFECTS, COST ANALYSIS, *COMPUTER SIMULATION,
1582 OIL SPILLS, OFFSHORE DRILLING, NORTH SEA, FATE, EVAPORATION, DISPERSIONS, SPILL RECOVERY, *EKOFISK WELL BLOWOUT,
1583 OIL SPILLS, MOVEMENT, MODELS, FATE, *GULF STREAM,
1584 OIL SPILLS, METABOLISM, MASSACHUSETTS, MARSHES, MARINE ORGANISMS, HYDROCARBONS, FATE, DISTRIBUTION, BIOLOGICAL EFFECTS,
1588 OIL SPILLS, OFFSHORE DRILLING, MOVEMENT, BASELINE STUDIES, ALASKA/GULF OF, *OCEAN CIRCULATION,
1590 OIL SPILLS, OCS, MODELS, FATE, BASELINE STUDIES, ALASKA, *CIRCULATION, *TRAJECTORY ANALYSIS,
1591 OIL SPILLS, OFFSHORE DEVELOPMENT, OCS, FATE, BASELINE STUDIES, ALASKA/GULF OF, *OCEAN CIRCULATION, *FLOW TRAJECTORIES,
1598 OIL SPILLS, ICE, SPREADING, *OIL TEMPERATURE, *ICE TEMPERATURE, *SPILLING RATE,
1599 OIL SPILLS, OCEANS, MODELS, FATE, *COMPUTER PROGRAMMING,
1600 OIL SPILLS, MOVEMENT, MODELS, DRIFT, *COMPUTER MODELING,
1602 OIL SPILLS, LIABILITY, LEGISLATION, CALIFORNIA, TANKERS, OIL TRANSPORT,
1605 OIL SPILLS, LIABILITY, LEGISLATION, SAFETY, TANKERS, US, *CONGRESSIONAL BILLS,
1607 OIL SPILLS, LEGISLATION, INTERNATIONAL AGREEMENTS, US, SHIPS, TANKERS, *LEGAL PROBLEMS,
1625 OIL SPILLS, OIL INDUSTRY, MARINE ORGANISMS, HYDROCARBONS, CHEMICAL ANALYSIS, BIBLIOGRAPHIES, SOURCE IDENTIFICATION,
1627 OIL SPILLS, HYDROCARBONS, BIODEGRADATION, BIBLIOGRAPHIES, BACTERIA, ALGAE, SPILL CLEANUP,
1629 OIL SPILLS, MARINE ORGANISMS, BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, BASELINE STUDIES, ARCTIC, SUBARCTIC REGIONS,
1633 OIL SPILLS, MARINE ORGANISMS, FATE, BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, SPILL CLEANUP,
1207 OIL TANKS, OIL SPILLS, OCS, ECONOMICS, ALASKA/GULF OF, OIL TRANSPORT, STORAGE, TANKERS, PIPELINES, *RISK ANALYSIS,
1232 OIL TANKS, EMULSIONS, BILGES, WASTE OIL TREATMENT, SPILL RECOVERY, *DEMULSIFYING AGENTS,
1441 OIL TANKS, GROUNDWATER, CONTAMINATION, CHEMICAL ANALYSIS, PETROLEUM PRODUCTS, USSR,
1018 OIL TRANSFER, OIL SPILLS, ISRAEL, CONTAMINATION, SPILL CLEANUP, PORTS, SHORELINES, *EILAT OIL TERMINAL,
1161 OIL TRANSFER, SPILL RECOVERY, *PORTABLE PUMPS,
1204 OIL TRANSFER, DESIGN-ENGINEERING, ARCTIC, SHIPS, *PUMPS, *ADAPTS,
1206 OIL TRANSFER, OIL DISCHARGES, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, PORTS, UK, *MILFORD HAVEN,
1220 OIL TRANSFER, MODELS, TANKERS, *ICE COOLING RATES,
1222 OIL TRANSFER, OFFSHORE DEVELOPMENT, MODELS, ENVIRONMENTAL EFFECTS, COST ANALYSIS, SOCIO-ECONOMIC EFFECTS, SPREADING,
1451 OIL TRANSFER, LEAKAGE, ENVIRONMENTAL EFFECTS, PORTS, POLLUTION PREVENTION, SPILL CLEANUP, UK, *MILFORD HAVEN,
1460 OIL TRANSFER, IRAQ, CONTAMINATION, RIVERS, WASTE OIL, TANKERS, *SHATT AL-ARAB,
1601 OIL TRANSFER, NEW JERSEY, LEGISLATION, COMPENSATION, REGULATIONS, SPILL CLEANUP, STATE GOVERNMENTS,
1620 OIL TRANSFER, GUIDELINES, CRUDE OIL, PETROLEUM PRODUCTS, TANKERS, SAFETY, *TERMINALS,
1624 OIL TRANSFER, OIL SLICKS, ICE, BIODEGRADATION, BIBLIOGRAPHIES, ARCTIC, CONTAINMENT, RECOVERY, STORAGE, SPILL DISPOSAL,
1064 OIL TRANSPORT, MONITORING, LEAKAGE, PIPELINES, *PIPELINE LEAK DETECTORS,
1202 OIL TRANSPORT, OIL SPILLS, LEGISLATION, TANKERS, PUGET SOUND, WASHINGTON,
1203 OIL TRANSPORT, OIL DISCHARGES, MARINE ORGANISMS, FISHERIES, FATE, BIOLOGICAL EFFECTS, SOURCES, PACIFIC OCEAN,
1207 OIL TRANSPORT, OIL TANKS, OIL SPILLS, OCS, ECONOMICS, ALASKA/GULF OF, STORAGE, TANKERS, PIPELINES, *RISK ANALYSIS,
1210 OIL TRANSPORT, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, WATER QUALITY, *BRYAN MOUND SALT DOMES,
1216 OIL TRANSPORT, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, WATER QUALITY, *WEST HACKBERRY SALT DOME,
1218 OIL TRANSPORT, OIL SPILLS, ENVIRONMENTAL EFFECTS, ALASKA, TANKERS, *VALDEZ NARROWS,
1219 OIL TRANSPORT, OIL SPILLS, OIL DISCHARGES, ENVIRONMENTAL EFFECTS, ECONOMICS, TANKERS, *SUPERTANKERS,
1223 OIL TRANSPORT, OIL SPILLS, MODELS, LEAKAGE, FATE, EVAPORATION, PIPELINES, SPREADING, *IGNITION HAZARDS,
1224 OIL TRANSPORT, OIL SPILLS, ENVIRONMENTAL EFFECTS, ALASKA, TANKERS, PORTS, *VALDEZ NARROWS,
1329 OIL TRANSPORT, OFFSHORE DRILLING, NORTH SEA, FATE, ENVIRONMENTAL EFFECTS, CRUDE OIL, POLLUTION PREVENTION, SPILL CLEANUP,
1332 OIL TRANSPORT, OFFSHORE DRILLING, OCS, HEALTH HAZARDS, POLLUTION PREVENTION, OIL WELLS, SAFETY,
1342 OIL TRANSPORT, OIL SPILLS, OIL INDUSTRY, ENVIRONMENTAL EFFECTS, POLLUTION PREVENTION, REFINING,
1486 OIL TRANSPORT, OIL SPILLS, OFFSHORE PRODUCTION, BIOLOGICAL EFFECTS, BERING SEA, BENTHOS, BASELINE STUDIES,

1596 OIL TRANSPORT, OCS, FATE, EIS, ATLANTIC COAST, *SUSPENDED MATTER,
1602 OIL TRANSPORT, OIL SPILLS, LIABILITY, LEGISLATION, CALIFORNIA, TANKERS,
1610 OIL TRANSPORT, LIABILITY, LEGISLATION, COST ANALYSIS, US, PORTS, TANKERS, *DEEPWATER PORT ACT,
1622 OIL TRANSPORT, LIABILITY, TANKERS, REGULATIONS, SAFETY, USCG,
1626 OIL TRANSPORT, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, BIBLIOGRAPHIES, PIPELINES,
1148 OIL-WATER SEPARATION, FUELS, DESIGN-ENGINEERING, SPILL RECOVERY, WASTE OIL, SKIMMERS,
1162 OIL-WATER SEPARATION, OFFSHORE DEVELOPMENT, NORTH SEA,
1174 OIL-WATER SEPARATION, SPILL CLEANUP, SKIMMERS, PATENT,
1178 OIL-WATER SEPARATION, DESIGN-ENGINEERING, SPILL RECOVERY,
1186 OIL-WATER SEPARATION, DESIGN-ENGINEERING, SPILL RECOVERY, PATENT,
1228 OIL-WATER SEPARATION, EMULSIONS, PATENT, *DEMULSIFICATION,
1229 OIL-WATER SEPARATION, EMULSIONS, WASTEWATER TREATMENT, SLUDGE,
1230 OIL-WATER SEPARATION, DESIGN-ENGINEERING, WASTEWATER TREATMENT,
1231 OIL-WATER SEPARATION, DESIGN-ENGINEERING,
1233 OIL-WATER SEPARATION, DESIGN-ENGINEERING, WASTEWATER TREATMENT, SHIPS, REFINERIES,
1234 OIL-WATER SEPARATION, FILTRATION, EMULSIONS, WASTE OIL DISPOSAL,
1235 OIL-WATER SEPARATION, INLAND, DESIGN-ENGINEERING, WASTEWATERS, SKIMMERS, *AFL INDUSTRIES,
1237 OIL-WATER SEPARATION, EMULSIONS, WASTEWATER TREATMENT, PH CONTROL, PATENT, *ZN SALTS,
1245 OIL-WATER SEPARATION, EMULSIONS, COALESCENCE, WASTEWATER TREATMENT,
1246 OIL-WATER SEPARATION, EMULSIONS, DESIGN-ENGINEERING, COALESCENCE,
1247 OIL-WATER SEPARATION, WASTEWATER TREATMENT, PETROCHEMICALS,
1248 OIL-WATER SEPARATION, DISPERSIONS, COALESCENCE, PATENT, *BROMINATED POLYETHYLENE GRANULES,
1251 OIL-WATER SEPARATION, FLOTATION, FLOCCULATION, COALESCENCE, WASTEWATER TREATMENT, REFINERIES, *OZONATION,
1252 OIL-WATER SEPARATION, FUELS, EMULSIONS, WASTEWATER TREATMENT, PATENT,
1253 OIL-WATER SEPARATION, FLOTATION, DESIGN-ENGINEERING, *AERATION, *WEMCO HYDROCLEANER,
1256 OIL-WATER SEPARATION, FILTRATION, DESIGN-ENGINEERING, PATENT,
1257 OIL-WATER SEPARATION, EMULSIONS, DESIGN-ENGINEERING, COALESCENCE, PATENT, *METAL CATALYSTS,
1258 OIL-WATER SEPARATION, FLOTATION, EMULSIONS, WASTEWATER TREATMENT, *AERATION, PATENT,
1260 OIL-WATER SEPARATION, FILTRATION, EMULSIONS, COAGULATION, PATENT,
1264 OIL-WATER SEPARATION, FILTRATION, BILGES, WASTEWATER TREATMENT, *TUBULAR ULTRAFILTRATION SYSTEM,
1265 OIL-WATER SEPARATION, EMULSIONS, WASTEWATER TREATMENT, *CELLULOSE FIBERS, PATENT,
1267 OIL-WATER SEPARATION, FLOTATION, WASTEWATER TREATMENT, PATENT, *POWDERED MICA,
1269 OIL-WATER SEPARATION, FILTRATION, EMULSIONS, COALESCENCE, PATENT,
1273 OIL-WATER SEPARATION, EMULSIONS, BILGES, SHIPS, WASTEWATER TREATMENT, *DEMULSIFICATION,
1274 OIL-WATER SEPARATION, DESIGN-ENGINEERING, COALESCENCE,
1275 OIL-WATER SEPARATION, HYDROCARBONS, DISPERSIONS, COALESCENCE, PATENT,
1278 OIL-WATER SEPARATION, DESIGN-ENGINEERING, PATENT,
1281 OIL-WATER SEPARATION, FLOTATION, FILTRATION, EMULSIONS, COALESCENCE, PATENT, *MAGNETIC POWDER,
1291 OIL-WATER SEPARATION, EMULSIONS, WASTEWATER TREATMENT, OXIDATION, PATENT,
1292 OIL-WATER SEPARATION, EMULSIONS, COALESCENCE, *FIBROUS BED COALESCERS,
1295 OIL-WATER SEPARATION, PATENT, *POLYPROPYLENE FOAM,
1297 OIL-WATER SEPARATION, GERMANY, WEST, REFINERIES, WASTEWATER TREATMENT, RECYCLING, SLUDGE,
1299 OIL-WATER SEPARATION, FLOTATION, EMULSIONS, WASTEWATER TREATMENT, REFINERIES, SKIMMERS,
1300 OIL-WATER SEPARATION, EMULSIONS, COALESCENCE, BILGES, WASTEWATER TREATMENT, *PEAT,
1302 OIL-WATER SEPARATION, WASTEWATER TREATMENT, *ELECTROFLOTATION, COAGULATION,
1303 OIL-WATER SEPARATION, EMULSIONS, WASTEWATER TREATMENT, REFINERIES, PATENT, *POLYVINYL CHLORIDE,
1305 OIL-WATER SEPARATION, DISPOSAL, WASTE OIL, RECYCLING, SLUDGE,
1306 OIL-WATER SEPARATION, FLOTATION, EMULSIONS, WASTEWATER TREATMENT, PH CONTROL, PATENT,
1318 OIL-WATER SEPARATION, DESIGN-ENGINEERING, WASTEWATER TREATMENT, RECYCLING,
1617 OIL-WATER SEPARATION, OIL DISCHARGES, MONITORING, INTERNATIONAL CONVENTIONS, IMCO, TANKERS, POLLUTION PREVENTION,
1619 OIL-WATER SEPARATION, OIL DISCHARGES, LAW ENFORCEMENT, INTERNATIONAL CONVENTIONS, SHIPS, POLLUTION CONTROL,
1142 OIL WELLS, INCINERATION, ICE, CANADA, ARCTIC, *BLOWOUTS, SPILL DISPOSAL,
1263 OIL WELLS, FLOCCULATION, DRILLING, BIODEGRADATION, BACTERIA, WASTEWATER TREATMENT, PATENT,
1332 OIL WELLS, OIL TRANSPORT, OFFSHORE DRILLING, OCS, HEALTH HAZARDS, POLLUTION PREVENTION, SAFETY,
1336 OIL WELLS, DISPOSAL, BEAUFORT SEA, BEACHES, SPILL CLEANUP, POLLUTION CONTROL, RESTORATION,
1504 OIL WELLS, FISH, DRILLING, ARCTIC, ACUTE EFFECTS, TOXICITY, *TROUT, *DRILLING MUDS,
1506 OIL WELLS, FISH, ENVIRONMENTAL EFFECTS, DRILLING, TOXICITY, *SALMON, *DRILLING MUDS,
1515 OIL WELLS, OIL INDUSTRY, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ATLANTIC COAST,
1540 OIL WELLS, MODELS, FATE, *SUBMARINE BLOWOUT SIMULATION, CONTAINMENT,
1013 OLYMPIC GAMES SPILL, FISHERIES, ENVIRONMENTAL EFFECTS, ARGO MERCHANT SPILL,

1198 OLYMPIC GAMES SPILL, OIL SPILLS, CONTAMINATION, BIRDS, RESTORATION, TORREY CANYON,
1199 OLYMPIC GAMES SPILL, BIRDS, RESTORATION, PERSONNEL TRAINING,
1447 ONSHORE IMPACTS, OFFSHORE DEVELOPMENT, MODELS, ALASKA,
1507 ONSHORE IMPACTS, OFFSHORE DRILLING, SOCIO-ECONOMIC EFFECTS, PRODUCTION,
1510 ONSHORE IMPACTS, OIL-GAS LEASING, OFFSHORE DEVELOPMENT, OCS, CALIFORNIA, POLLUTION CONTROL,
1519 ONSHORE IMPACTS, OFFSHORE DEVELOPMENT, LEGISLATION, CALIFORNIA COAST,
1530 ONSHORE IMPACTS, OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS,
1535 ONSHORE IMPACTS, OFFSHORE DEVELOPMENT, NEW JERSEY, DELAWARE, COASTS, PORTS, SOCIO-ECONOMIC EFFECTS,
1536 ONSHORE IMPACTS, OFFSHORE DRILLING, CALIFORNIA COAST, POLLUTION PREVENTION, *LAND USE CONFLICTS,
1542 ONSHORE IMPACTS, OFFSHORE DEVELOPMENT, OCS, HABITAT, BIOLOGICAL EFFECTS, SPILL CLEANUP, POLLUTION PREVENTION,
1606 ONSHORE IMPACTS, OIL-GAS LEASING, OFFSHORE DEVELOPMENT, LEGISLATION, ENVIRONMENTAL PROTECTION, US, *OCS LANDS ACT AMENDMENTS,
1236 OXIDATION, FLOTATION, PETROCHEMICALS, WASTEWATER TREATMENT, PH CONTROL, COAGULATION,
1259 OXIDATION, WASTEWATER TREATMENT, REFINERIES, *OXYGEN AERATION,
1272 OXIDATION, ACTIVATED SLUDGE, WASTEWATER TREATMENT, REFINERIES, PATENT,
1286 OXIDATION, HYDROCARBONS, CHEMICAL ANALYSIS, WASTEWATER TREATMENT, TOXICITY, *AERATION,
1291 OXIDATION, OIL-WATER SEPARATION, EMULSIONS, WASTEWATER TREATMENT, PATENT,
1549 OXIDATION, HYDROCARBONS, BIODEGRADATION, BACTERIA, TOXICITY, SURFACTANTS, *IONIC CONCENTRATION, *DETERGENTS,
1556 OXIDATION, MICROORGANISMS, CRUDE OIL, BIODEGRADATION, BEACHES, *BEACH GRAVEL,
1203 PACIFIC OCEAN, OIL TRANSPORT, OIL DISCHARGES, MARINE ORGANISMS, FISHERIES, FATE, BIOLOGICAL EFFECTS, SOURCES,
1086 PAH, HEALTH HAZARDS, SAMPLING, SOIL, REFINERIES, PETROCHEMICALS, *AGRICULTURE, POLAND,
1089 PAH, MODELS, CARCINOGENS, *BENZO(A)ANTHRACENE,
1098 PAH, CRUDE OIL, CHROMATOGRAPHY, CHEMICAL ANALYSIS, CARCINOGENS, SPECTROMETRY,
1109 PAH, EXTRACTION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, *FLUORESCENCE,
1117 PAH, LAKES, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, SEDIMENTS, SPECTROMETRY,
1126 PAH, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, SOURCES, SPECTROMETRY, SEDIMENTS, *AQUATIC ENVIRONMENT,
1131 PAH, HYDROCARBONS, CRUDE OIL, SOURCE IDENTIFICATION, SEDIMENTS, SOIL, PETROLEUM PRODUCTS,
1362 PAH, FISH, PETROLEUM PRODUCTS, UPTAKE, RELEASE, *3,4-BENZOPYRENE,
1039 PATENT, MONITORING, HYDROCARBONS, BALLAST, PETROLEUM PRODUCTS, WASTEWATERS, *SOUND VELOCITY CHARACTERISTICS,
1042 PATENT, OIL SLICKS, MONITORING, DESIGN-ENGINEERING, BALLAST, TANKERS,
1044 PATENT, MONITORING, LEAKAGE, DETECTION, PIPELINES, *MOBILE RECEIVER,
1050 PATENT, OFFSHORE DRILLING, MONITORING, DESIGN-ENGINEERING, *OIL-IN-WATER,
1053 PATENT, MONITORING, DETECTION, CONTAMINANTS, *OIL-IN-WATER,
1068 PATENT, MONITORING, FUEL OIL, DETECTION, DESIGN-ENGINEERING, CRUDE OIL, CONTAMINANTS, *OPTICAL SENSOR,
1069 PATENT, OIL SLICKS, MONITORING, DESIGN-ENGINEERING, *LIGHT SENSOR,
1081 PATENT, OIL SLICKS, DESIGN-ENGINEERING, SAMPLING, SURFACTANTS,
1132 PATENT, DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT,
1133 PATENT, DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT,
1136 PATENT, DESIGN-ENGINEERING, BOOMS, SPILL CONTAINMENT, *FENDING DEVICE,
1138 PATENT, HYDROCARBONS, DESIGN-ENGINEERING, BOOMS, ABSORPTION, SPILL CONTAINMENT,
1139 PATENT, HYDROCARBONS, DESIGN-ENGINEERING, BOOMS, ADSORPTION, SPILL CONTAINMENT,
1140 PATENT, OIL SLICKS, DESIGN-ENGINEERING, BOOMS, SPILL CLEANUP, SKIMMERS,
1155 PATENT, DESIGN-ENGINEERING, SPILL RECOVERY, *UNDERWATER FISSURES,
1156 PATENT, DESIGN-ENGINEERING, SPILL RECOVERY,
1158 PATENT, DESIGN-ENGINEERING, SPILL CLEANUP, SKIMMERS,
1159 PATENT, EMULSIONS, DISPERSANTS, SPILL CLEANUP, SURFACTANTS,
1160 PATENT, MICROORGANISMS, BIODEGRADATION, SPILL DISPOSAL, SOIL,
1165 PATENT, DESIGN-ENGINEERING, ABSORPTION, SPILL RECOVERY, *SORBENT BROADCASTER,
1166 PATENT, DESIGN-ENGINEERING, CONTAMINANTS, SPILL RECOVERY, SKIMMERS,
1167 PATENT, DESIGN-ENGINEERING, SPILL RECOVERY, SKIMMERS,
1170 PATENT, DESIGN-ENGINEERING, SPILL RECOVERY,
1171 PATENT, ABSORPTION, SPILL RECOVERY, *GLASS FIBER BLANKETS,
1174 PATENT, OIL-WATER SEPARATION, SPILL CLEANUP, SKIMMERS,
1175 PATENT, OIL SLICKS, MICROORGANISMS, BIODEGRADATION, SPILL CLEANUP, *NUTRIENT PARTICLES,
1176 PATENT, ABSORPTION, SPILL RECOVERY, *ABSORBENT POLYMERS,
1177 PATENT, ABSORPTION, SPILL RECOVERY, SKIMMERS, *ABSORBENT POWDER,
1179 PATENT, DESIGN-ENGINEERING, SPILL RECOVERY, *OIL MOP RIGGING SYSTEM,
1180 PATENT, DESIGN-ENGINEERING, SPILL RECOVERY, *GUIDED JET,
1182 PATENT, ABSORPTION, SPILL CLEANUP, WASTE OIL, RIVERS, SEAWATER,
1183 PATENT, ADSORPTION, SPILL RECOVERY,
1184 PATENT, DESIGN-ENGINEERING, SKIMMERS, SHIPS, *WAVE DAMPING DEVICE,
1186 PATENT, OIL-WATER SEPARATION, DESIGN-ENGINEERING, SPILL RECOVERY,
1187 PATENT, DISPERSIONS, SPILL CLEANUP, *ASBESTOS MINE WASTES,
1190 PATENT, SPILL RECOVERY, PETROLEUM PRODUCTS, *ADHESIVE POLYMER FILM,
1191 PATENT, EMULSIONS, ABSORPTION, *POLYURETHANE FOAM CHIPS,

1192 PATENT, ADSORPTION, *POLYURETHANE FOAM,
1195 PATENT, DESIGN-ENGINEERING, SPILL RECOVERY, *FLEXIBLE FLOATING PIPE,
1196 PATENT, DESIGN-ENGINEERING, BOOMS, SPILL CLEANUP, SKIMMERS,
1228 PATENT, OIL-WATER SEPARATION, EMULSIONS, *DEMULSIFICATION,
1237 PATENT, OIL-WATER SEPARATION, EMULSIONS, WASTEWATER TREATMENT, PH CONTROL, *ZN SALTS,
1243 PATENT, FILTRATION, DESIGN-ENGINEERING, COALESCENCE, WASTEWATER TREATMENT, PETROLEUM PRODUCTS,
1244 PATENT, LUBRICATING OIL, WASTE OIL TREATMENT, RECLAMATION,
1248 PATENT, OIL-WATER SEPARATION, DISPERSIONS, COALESCENCE, *BROMINATED POLYETHYLENE GRANULES,
1252 PATENT, OIL-WATER SEPARATION, FUELS, EMULSIONS, WASTEWATER TREATMENT,
1256 PATENT, OIL-WATER SEPARATION, FILTRATION, DESIGN-ENGINEERING,
1257 PATENT, OIL-WATER SEPARATION, EMULSIONS, DESIGN-ENGINEERING, COALESCENCE, *METAL CATALYSTS,
1258 PATENT, OIL-WATER SEPARATION, FLOTATION, EMULSIONS, WASTEWATER TREATMENT, *AERATION,
1260 PATENT, OIL-WATER SEPARATION, FILTRATION, EMULSIONS, COAGULATION,
1263 PATENT, OIL WELLS, FLOCCULATION, DRILLING, BIODEGRADATION, BACTERIA, WASTEWATER TREATMENT,
1265 PATENT, OIL-WATER SEPARATION, EMULSIONS, WASTEWATER TREATMENT, *CELLULOSE FIBERS,
1266 PATENT, FILTRATION, EMULSIONS, DESIGN-ENGINEERING, WASTEWATER TREATMENT, PH CONTROL,
1267 PATENT, OIL-WATER SEPARATION, FLOTATION, WASTEWATER TREATMENT, *POWDERED MICA,
1269 PATENT, OIL-WATER SEPARATION, FILTRATION, EMULSIONS, COALESCENCE,
1272 PATENT, OXIDATION, ACTIVATED SLUDGE, WASTEWATER TREATMENT, REFINERIES,
1275 PATENT, OIL-WATER SEPARATION, HYDROCARBONS, DISPERSIONS, COALESCENCE,
1277 PATENT, HYDROCARBONS, FUEL OIL, FLOCCULATION, WASTEWATER TREATMENT, PH CONTROL,
1278 PATENT, OIL-WATER SEPARATION, DESIGN-ENGINEERING,
1281 PATENT, OIL-WATER SEPARATION, FLOTATION, FILTRATION, EMULSIONS, COALESCENCE, *MAGNETIC POWDER,
1283 PATENT, OIL SLICKS, ABSORPTION, WASTEWATER TREATMENT, SPILL RECOVERY, *POLYURETHANE,
1291 PATENT, OXIDATION, OIL-WATER SEPARATION, EMULSIONS, WASTEWATER TREATMENT,
1295 PATENT, OIL-WATER SEPARATION, *POLYPROPYLENE FOAM,
1298 PATENT, INDUSTRIES, WASTEWATER TREATMENT, POLLUTION CONTROL, REFINERIES, SPILL CLEANUP,
1303 PATENT, OIL-WATER SEPARATION, EMULSIONS, WASTEWATER TREATMENT, REFINERIES, *POLYVINYL CHLORIDE,
1306 PATENT, OIL-WATER SEPARATION, FLOTATION, EMULSIONS, WASTEWATER TREATMENT, PH CONTROL,
1311 PATENT, LUBRICATING OIL, RECLAMATION, SURFACTANTS,
1313 PATENT, LUBRICATING OIL, FILTRATION, WASTE OIL, RECLAMATION,
1319 PATENT, LUBRICATING OIL, FLOCCULATION, WASTE OIL TREATMENT, RECLAMATION, SURFACTANTS, PRECIPITATION,
1320 PATENT, LUBRICATING OIL, WASTE OIL, RECLAMATION, REFINING,
1334 PATENT, LEAKAGE, DETECTION, PIPELINES, *ACOUSTIC LEAK DETECTION,
1551 PATENT, OIL SLICKS, DESIGN-ENGINEERING, BIODEGRADATION, BACTERIA, SPILL CLEANUP,
1199 PERSONNEL TRAINING, OLYMPIC GAMES SPILL, BIRDS, RESTORATION,
1321 PERSONNEL TRAINING, OIL SPILLS, POLLUTION CONTROL, *SPILL CONTROL SCHOOL,
1086 PETROCHEMICALS, PAH, HEALTH HAZARDS, SAMPLING, SOIL, REFINERIES, *AGRICULTURE, POLAND,
1092 PETROCHEMICALS, MEXICO/GULF OF, HYDROCARBONS, CHEMICAL ANALYSIS, SAMPLING, REFINERIES, SOURCES, *MISSISSIPPI DELTA,
1113 PETROCHEMICALS, INDUSTRIES, ANALYTICAL TECHNIQUES, WASTE OIL, *X-RAY FLUORESCENCE,
1236 PETROCHEMICALS, OXIDATION, FLOTATION, WASTEWATER TREATMENT, PH CONTROL, COAGULATION,
1238 PETROCHEMICALS, OIL INDUSTRY, MANUALS, WASTEWATER TREATMENT, REFINERIES, POLLUTION CONTROL,
1247 PETROCHEMICALS, OIL-WATER SEPARATION, WASTEWATER TREATMENT,
1270 PETROCHEMICALS, REFINERIES, WASTEWATER TREATMENT, *PHYSICAL-CHEMICAL METHODS,
1279 PETROCHEMICALS, CONTAMINATION, WASTE OIL, PETROLEUM PRODUCTS, REFINING, RIVERS, USSR,
1280 PETROCHEMICALS, REFINERIES, WASTEWATER TREATMENT, *BIOCHEMICAL PURIFICATION,
1282 PETROCHEMICALS, AROMATIC HYDROCARBONS, ABSORPTION, WASTEWATER TREATMENT,
1284 PETROCHEMICALS, FILTRATION, ADSORPTION, WASTEWATER TREATMENT,
1338 PETROCHEMICALS, FUELS, REFINERIES, POLLUTION PREVENTION, WASTEWATER TREATMENT,
1413 PETROCHEMICALS, FISH, TOXICITY, PETROLEUM PRODUCTS,
1509 PETROCHEMICALS, OIL INDUSTRY, ENVIRONMENTAL EFFECTS, DEVELOPMENT, REFINERIES,
1039 PETROLEUM PRODUCTS, PATENT, MONITORING, HYDROCARBONS, BALLAST, WASTEWATERS, *SOUND VELOCITY CHARACTERISTICS,
1057 PETROLEUM PRODUCTS, NORWEGIAN SEA, NORTH SEA, MONITORING, BALTIC SEA,
1102 PETROLEUM PRODUCTS, HYDROCARBONS, FLORIDA, COASTS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, BIODEGRADATION, BACTERIA, SEDIMENTS,
1105 PETROLEUM PRODUCTS, EXTRACTION, ANALYTICAL TECHNIQUES, *GRAVIMETRIC DETERMINATION, SOLVENTS,
1108 PETROLEUM PRODUCTS, OCEANS, CONTAMINATION, CHEMICAL ANALYSIS, SEDIMENTS, PORTS, USSR,
1112 PETROLEUM PRODUCTS, DETECTION, ANALYTICAL TECHNIQUES, SEAWATER, *NAPHTHENIC ACIDS,
1131 PETROLEUM PRODUCTS, PAH, HYDROCARBONS, CRUDE OIL, SOURCE IDENTIFICATION, SEDIMENTS, SOIL,
1190 PETROLEUM PRODUCTS, PATENT, SPILL RECOVERY, *ADHESIVE POLYMER FILM,
1242 PETROLEUM PRODUCTS, DISPOSAL, CONTAMINANTS, WASTEWATER TREATMENT,
1243 PETROLEUM PRODUCTS, PATENT, FILTRATION, DESIGN-ENGINEERING, COALESCENCE, WASTEWATER TREATMENT,

1262 PETROLEUM PRODUCTS, ACTIVATED SLUDGE, WASTE OIL TREATMENT,
1279 PETROLEUM PRODUCTS, PETROCHEMICALS, CONTAMINATION, WASTE OIL, REFINING, RIVERS, USSR,
1361 PETROLEUM PRODUCTS, MARINE ORGANISMS, FISH, BLACK SEA, BENTHOS, TOXICITY, *SHRIMP, *ELECTRICAL CURRENTS,
1362 PETROLEUM PRODUCTS, PAH, FISH, UPTAKE, RELEASE, *3,4-BENZOPYRENE,
1383 PETROLEUM PRODUCTS, MOLLUSKS, CALIFORNIA/SOUTHERN, BIOLOGICAL EFFECTS, *TOLERANCE VARIABILITY, *LITTORINA,
1397 PETROLEUM PRODUCTS, METABOLISM, INVERTEBRATES, FISH, TOXICITY,
1401 PETROLEUM PRODUCTS, CRUDE OIL, CONTAMINATION, BIOLOGICAL EFFECTS,
1406 PETROLEUM PRODUCTS, OCEANS, FOOD WEB, CONTAMINATION, BIOLOGICAL EFFECTS, PHYTOPLANKTON,
1413 PETROLEUM PRODUCTS, PETROCHEMICALS, FISH, TOXICITY,
1432 PETROLEUM PRODUCTS, MARINE ORGANISMS, CONTAMINANTS, BIOLOGICAL EFFECTS, *PHYSIOLOGICAL RESPONSE,
1441 PETROLEUM PRODUCTS, OIL TANKS, GROUNDWATER, CONTAMINATION, CHEMICAL ANALYSIS, USSR,
1456 PETROLEUM PRODUCTS, TOXICITY, *CONTROLLED MARINE ECOSYSTEMS ,
1463 PETROLEUM PRODUCTS, CRUDE OIL, CONTAMINATION,
1547 PETROLEUM PRODUCTS, MONITORING, CRUSTACEANS, CRUDE OIL, BIODEGRADATION, ARCTIC, TOXICITY, *AMPHIPODS,
1557 PETROLEUM PRODUCTS, MICROORGANISMS, FUELS, BIODEGRADATION,
1564 PETROLEUM PRODUCTS, OIL SPILLS, BIODEGRADATION, BACTERIA,
1620 PETROLEUM PRODUCTS, OIL TRANSFER, GUIDELINES, CRUDE OIL, TANKERS, SAFETY, *TERMINALS,
1236 PH CONTROL, PETROCHEMICALS, OXIDATION, FLOTATION, WASTEWATER TREATMENT, COAGULATION,
1237 PH CONTROL, PATENT, OIL-WATER SEPARATION, EMULSIONS, WASTEWATER TREATMENT, *ZN SALTS,
1266 PH CONTROL, PATENT, FILTRATION, EMULSIONS, DESIGN-ENGINEERING, WASTEWATER TREATMENT,
1277 PH CONTROL, PATENT, HYDROCARBONS, FUEL OIL, FLOCCULATION, WASTEWATER TREATMENT,
1287 PH CONTROL, FLOTATION, EMULSIONS, WASTEWATER TREATMENT, SLUDGE, COAGULATION, *AERATION,
1306 PH CONTROL, PATENT, OIL-WATER SEPARATION, FLOTATION, EMULSIONS, WASTEWATER TREATMENT,
1437 PHYSICAL EFFECTS, OIL SLICKS, *REAERATION RATES,
1465 PHYSICAL EFFECTS, OIL SLICKS, BIOLOGICAL EFFECTS, ANIMALS, PLANTS, *OXYGEN EXCHANGE, *TEMPERATURE, *LIGHT REDUCTION, *ROCK POOLS,
1570 PHYSICAL EFFECTS, OIL SLICKS, DRIFT, SPREADING, WEATHERING,
1193 PHYTOPLANKTON, EMULSIFIERS, SOLVENTS, SURFACTANTS, TOXICITY,
1348 PHYTOPLANKTON, ICE, BEAUFORT SEA, ALGAE, *PRIMARY PRODUCTIVITY, *OIL-UNDER-ICE,
1389 PHYTOPLANKTON, MARSHES, CRUDE OIL, BIOLOGICAL EFFECTS, *ENVIRONMENTAL STRESS, *DIATOMS,
1392 PHYTOPLANKTON, MARINE ORGANISMS, FRANCE, ENVIRONMENTAL EFFECTS, BIODEGRADATION, BACTERIA, REFINERIES, WASTEWATERS,
1406 PHYTOPLANKTON, PETROLEUM PRODUCTS, OCEANS, FOOD WEB, CONTAMINATION, BIOLOGICAL EFFECTS,
1412 PHYTOPLANKTON, BIOLOGICAL EFFECTS, *DINOFLAGELLATES, *DIATOMS,
1418 PHYTOPLANKTON, LAKES, HYDROCARBONS, BIOLOGICAL EFFECTS, *OUTBOARD MARINE ENGINE EXHAUST,
1427 PHYTOPLANKTON, MARINE ORGANISMS, EMULSIFIERS, TOXICITY,
1467 PHYTOPLANKTON, OFFSHORE DEVELOPMENT, MONITORING, ICE, FOOD WEB, BIOLOGICAL EFFECTS, BERING SEA, BASELINE STUDIES,
1494 PHYTOPLANKTON, OFFSHORE DEVELOPMENT, MONITORING, BIOLOGICAL EFFECTS, BASELINE STUDIES, *PRIMARY PRODUCTION,
1044 PIPELINES, PATENT, MONITORING, LEAKAGE, DETECTION, *MOBILE RECEIVER,
1064 PIPELINES, OIL TRANSPORT, MONITORING, LEAKAGE, *PIPELINE LEAK DETECTORS,
1207 PIPELINES, OIL TRANSPORT, OIL TANKS, OIL SPILLS, OCS, ECONOMICS, ALASKA/GULF OF, STORAGE, TANKERS, *RISK ANALYSIS,
1223 PIPELINES, OIL TRANSPORT, OIL SPILLS, MODELS, LEAKAGE, FATE, EVAPORATION, SPREADING, *IGNITION HAZARDS,
1227 PIPELINES, OIL SPILLS, LIABILITY, LEGISLATION, ENVIRONMENTAL EFFECTS, DEVELOPMENT, ALASKA,
1334 PIPELINES, PATENT, LEAKAGE, DETECTION, *ACOUSTIC LEAK DETECTION,
1522 PIPELINES, OIL SPILLS, OFFSHORE DEVELOPMENT, OCS, MARSHES, LOUISIANA, ENVIRONMENTAL EFFECTS, *LAFOURCHE PARISH,
1626 PIPELINES, OIL TRANSPORT, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, BIBLIOGRAPHIES,
1088 PLANKTON, HYDROCARBONS, FISH, CHEMICAL ANALYSIS, BEAUFORT SEA, SAMPLING, SEAWATER, SEDIMENTS, SOURCES,
1462 PLANKTON, OIL SPILLS, MONITORING, FISHERIES, ENVIRONMENTAL EFFECTS, CHINA, *HONG KONG,
1481 PLANKTON, OFFSHORE DEVELOPMENT, MONITORING, DISTRIBUTION, BIOLOGICAL EFFECTS, BASELINE STUDIES, ALASKA/GULF OF, *ICHTHYOPLANKTON,
1482 PLANKTON, MONITORING, DISTRIBUTION, BIBLIOGRAPHIES, BEAUFORT SEA, BASELINE STUDIES,
1493 PLANKTON, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ECOSYSTEMS, BENTHOS,
1356 PLANTS, CRUDE OIL, BIOLOGICAL EFFECTS, ARCTIC, ALGAE, ALASKA, *LICHENS,
1365 PLANTS, OIL SPILLS, MARSHES, BIOLOGICAL EFFECTS, SAMPLING, *SPECIES REDUCTION,
1408 PLANTS, HYDROCARBONS, FOOD WEB, BIOLOGICAL EFFECTS, *PHOTOSYNTHESIS, *ZOSTERA MARINA,
1465 PLANTS, PHYSICAL EFFECTS, OIL SLICKS, BIOLOGICAL EFFECTS, ANIMALS, *OXYGEN EXCHANGE, *TEMPERATURE, *LIGHT REDUCTION, *ROCK POOLS,
1623 PLANTS, OIL INDUSTRY, HEALTH HAZARDS, GUIDELINES, STORAGE, SAFETY, *BULK PETROLEUM
1353 PLATFORMS, NATURAL SEEPAGE, MARINE ORGANISMS, CRUDE OIL, CHRONIC EFFECTS, BIOLOGICAL EFFECTS, API,
1400 PLATFORMS, NATURAL SEEPAGE, MARINE ORGANISMS, CRUDE OIL, CHRONIC EFFECTS, BIOLOGICAL EFFECTS, API,
1468 PLATFORMS, OFFSHORE PRODUCTION, NATURAL SEEPAGE, MARINE ORGANISMS, ENVIRONMENTAL

EFFECTS, API,
1513 PLATFORMS, OIL INDUSTRY, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, REGULATIONS,
1086 POLAND, PETROCHEMICALS, PAH, HEALTH HAZARDS, SAMPLING, SOIL, REFINERIES, *AGRICULTURE,
1096 POLLUTION CONTROL, OIL INDUSTRY, ANALYTICAL TECHNIQUES, WATER QUALITY, WASTEWATERS,
SAMPLING, *ON-LINE INSTRUMENTATION,
1152 POLLUTION CONTROL, DESIGN-ENGINEERING, SOUTH AFRICA, *SALVAGE TUG, SPILL CLEANUP,
1153 POLLUTION CONTROL, DESIGN-ENGINEERING, SOUTH AFRICA, *SALVAGE TUG, SPILL CLEANUP,
1205 POLLUTION CONTROL, ENVIRONMENTAL PROTECTION, COST ANALYSIS, TANKERS, SEGREGATED
BALLAST , REGULATIONS, USCG,
1238 POLLUTION CONTROL, PETROCHEMICALS, OIL INDUSTRY, MANUALS, WASTEWATER TREATMENT,
REFINERIES,
1298 POLLUTION CONTROL, PATENT, INDUSTRIES, WASTEWATER TREATMENT, REFINERIES, SPILL CLEANUP,
1321 POLLUTION CONTROL, PERSONNEL TRAINING, OIL SPILLS, *SPILL CONTROL SCHOOL,
1330 POLLUTION CONTROL, OIL DISCHARGES, MONITORING, IMCO, TANKERS, REGULATIONS, *BAILEY
MONITOR PROGRAM,
1336 POLLUTION CONTROL, OIL WELLS, DISPOSAL, BEAUFORT SEA, BEACHES, SPILL CLEANUP,
RESTORATION,
1337 POLLUTION CONTROL, MONITORING, DISPOSAL, DETECTION, BEAUFORT SEA, SPILL CLEANUP,
*EQUIPMENT EVALUATION,
1339 POLLUTION CONTROL, NETHERLANDS, LEGISLATION, LAW ENFORCEMENT, HARBORS, TANKERS, WATER
QUALITY,
1344 POLLUTION CONTROL, BOOMS, SPILL CLEANUP, SKIMMERS,
1345 POLLUTION CONTROL, CANADA, SPILL RECOVERY, SKIMMERS, *EQUIPMENT TESTING,
1346 POLLUTION CONTROL, OIL SPILLS, LAW ENFORCEMENT, HARBORS, SHIPS, UK, *MILFORD HAVEN,
1440 POLLUTION CONTROL, MODELS, ECONOMIC EFFECTS, REFINERIES, WASTEWATERS, *INDUSTRY COSTS,
1443 POLLUTION CONTROL, OIL SPILLS, POLLUTION PREVENTION,
1445 POLLUTION CONTROL, OIL SPILLS, CHESAPEAKE BAY, SHIPS, PORTS, *SYMPOSIUM,
1510 POLLUTION CONTROL, ONSHORE IMPACTS, OIL-GAS LEASING, OFFSHORE DEVELOPMENT, OCS,
CALIFORNIA,
1559 POLLUTION CONTROL, MICROORGANISMS, HYDROCARBONS, BIODEGRADATION,
1614 POLLUTION CONTROL, INTERNATIONAL CONVENTIONS, REGULATIONS, TANKERS, SEGREGATED BALLAST,
1616 POLLUTION CONTROL, OFFSHORE DEVELOPMENT, NORTH SEA, LIABILITY, INTERNATIONAL
CONVENTIONS, EUROPE, REGULATIONS,
1619 POLLUTION CONTROL, OIL-WATER SEPARATION, OIL DISCHARGES, LAW ENFORCEMENT,
INTERNATIONAL CONVENTIONS, SHIPS,
1621 POLLUTION CONTROL, MONITORING, GUIDELINES, CANADA, REFINERIES, WASTEWATERS,
REGULATIONS,
1010 POLLUTION PREVENTION, TANKERS, SAFETY, US, *LIBERIAN REGISTRY LAWS,
1033 POLLUTION PREVENTION, OIL SLICKS, MONITORING, BALLAST, TANKERS, *OIL-WATER INTERFACE,
1066 POLLUTION PREVENTION, MONITORING, CONTAMINANTS, *UN,
1080 POLLUTION PREVENTION, OIL SPILLS, MODELS, DETECTION, COASTS, REMOTE SENSING, *LINEAR
PROGRAMMING,
1145 POLLUTION PREVENTION, SPILL CLEANUP, SAFETY, REGULATIONS, USCG,
1157 POLLUTION PREVENTION, OIL SLICKS, SPILL RECOVERY, USN, *GELATION, *AMINE CARBAMATES,
1200 POLLUTION PREVENTION, OIL SPILLS, LEGISLATION, TANKERS, US,
1221 POLLUTION PREVENTION, MONITORING, IMCO, REGULATIONS, SHIPS,
1322 POLLUTION PREVENTION, OIL SPILLS, LIABILITY, CONTINGENCY PLANNING, *LEGAL
RESPONSIBILITIES,
1325 POLLUTION PREVENTION, FRANCE, CRUDE OIL, SPILL CLEANUP, *POLMAR PLAN,
1326 POLLUTION PREVENTION, LEAKAGE, SHIPS, *STERN GEAR SYSTEM,
1327 POLLUTION PREVENTION, OIL SPILLS, LIABILITY, COMPENSATION, SPILL CLEANUP,
*CONGRESSIONAL BILL,
1329 POLLUTION PREVENTION, OIL TRANSPORT, OFFSHORE DRILLING, NORTH SEA, FATE, ENVIRONMENTAL
EFFECTS, CRUDE OIL, SPILL CLEANUP,
1331 POLLUTION PREVENTION, OIL DISCHARGES, EPA, DRILLING, CONTINGENCY PLANNING,
REGULATIONS, *NAVIGABLE WATERS,
1332 POLLUTION PREVENTION, OIL WELLS, OIL TRANSPORT, OFFSHORE DRILLING, OCS, HEALTH
HAZARDS, SAFETY,
1333 POLLUTION PREVENTION, OIL SPILLS, OFFSHORE DEVELOPMENT, NORTH SEA, *SUPPORT SYSTEMS,
1338 POLLUTION PREVENTION, PETROCHEMICALS, FUELS, REFINERIES, WASTEWATER TREATMENT,
1341 POLLUTION PREVENTION, MICHIGAN, WASTEWATER TREATMENT, *FREEWAY RUNOFF,
1342 POLLUTION PREVENTION, OIL TRANSPORT, OIL SPILLS, OIL INDUSTRY, ENVIRONMENTAL EFFECTS,
REFINING,
1343 POLLUTION PREVENTION, LAW ENFORCEMENT, SPILL CLEANUP, SURVEILLANCE, SOURCE
IDENTIFICATION, USCG,
1443 POLLUTION PREVENTION, POLLUTION CONTROL, OIL SPILLS,
1450 POLLUTION PREVENTION, OCEANS,
1451 POLLUTION PREVENTION, OIL TRANSFER, LEAKAGE, ENVIRONMENTAL EFFECTS, PORTS, SPILL
CLEANUP, UK, *MILFORD HAVEN,
1528 POLLUTION PREVENTION, OFFSHORE PRODUCTION, ENVIRONMENTAL PROTECTION, ECONOMICS, SAFETY,
1536 POLLUTION PREVENTION, ONSHORE IMPACTS, OFFSHORE DRILLING, CALIFORNIA COAST, *LAND USE
CONFLICTS,
1542 POLLUTION PREVENTION, ONSHORE IMPACTS, OFFSHORE DEVELOPMENT, OCS, HABITAT, BIOLOGICAL
EFFECTS, SPILL CLEANUP,
1611 POLLUTION PREVENTION, OIL DISCHARGES, LIABILITY, LEGISLATION, FOREIGN GOVERNMENTS, US,

1613 POLLUTION PREVENTION, LEGISLATION, FRANCE, TANKERS, *FRENCH MARITIME LAW, *OLYMPIC BRAVERY SPILL,
1615 POLLUTION PREVENTION, LIABILITY, INTERNATIONAL CONVENTIONS, IMCO, HARBORS, COMPENSATION, COASTS, SHIPS,
1617 POLLUTION PREVENTION, OIL-WATER SEPARATION, OIL DISCHARGES, MONITORING, INTERNATIONAL CONVENTIONS, IMCO, TANKERS,
1618 POLLUTION PREVENTION, LEGISLATION, INTERNATIONAL CONVENTIONS, IMCO,
1393 POLYCHAETES, DISPERSANTS, CRUDE OIL, BIOLOGICAL EFFECTS, UK, *ARENICOLA MARINA L, *MILFORD HAVEN,
1416 POLYCHAETES, FUEL OIL, AROMATIC HYDROCARBONS, UPTAKE, RELEASE, *NAPHTHALENE, *NEANTHES ARENACEODENTATA,
1018 PORTS, OIL TRANSFER, OIL SPILLS, ISRAEL, CONTAMINATION, SPILL CLEANUP, SHORELINES, *EILAT OIL TERMINAL,
1108 PORTS, PETROLEUM PRODUCTS, OCEANS, CONTAMINATION, CHEMICAL ANALYSIS, SEDIMENTS, USSR,
1206 PORTS, OIL TRANSFER, OIL DISCHARGES, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, UK, *MILFORD HAVEN,
1224 PORTS, OIL TRANSPORT, OIL SPILLS, ENVIRONMENTAL EFFECTS, ALASKA, TANKERS, *VALDEZ NARROWS,
1357 PORTS, OIL SPILLS, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, WASTEWATERS, REFINERIES, UK, *MILFORD HAVEN,
1358 PORTS, OIL SPILLS, MONITORING, BIOLOGICAL EFFECTS, WASTEWATERS, REFINERIES, UK, *MILFORD HAVEN, *OIL POLLUTION RESEARCH UNIT,
1402 PORTS, OIL SPILLS, METULA SPILL, MARSHES, MARINE ORGANISMS, BIOLOGICAL EFFECTS, TANKERS, UK, *MILFORD HAVEN,
1445 PORTS, POLLUTION CONTROL, OIL SPILLS, CHESAPEAKE BAY, SHIPS, *SYMPOSIUM,
1451 PORTS, POLLUTION PREVENTION, OIL TRANSFER, LEAKAGE, ENVIRONMENTAL EFFECTS, SPILL CLEANUP, UK, *MILFORD HAVEN,
1512 PORTS, OIL DISCHARGES, ENVIRONMENTAL EFFECTS, EIS, REGULATIONS, SAFETY, *DEEPWATER PORT,
1529 PORTS, OFFSHORE DEVELOPMENT, LIABILITY, INSURANCE, REGULATIONS, SHIPS,
1535 PORTS, ONSHORE IMPACTS, OFFSHORE DEVELOPMENT, NEW JERSEY, DELAWARE, COASTS, SOCIO-ECONOMIC EFFECTS,
1610 PORTS, OIL TRANSPORT, LIABILITY, LEGISLATION, COST ANALYSIS, US, TANKERS, *DEEPWATER PORT ACT,
1019 PORTUGAL, SPILL CLEANUP, TANKERS, *JAKOB MAERSK SPILL,
1319 PRECIPITATION, PATENT, LUBRICATING OIL, FLOCCULATION, WASTE OIL TREATMENT, RECLAMATION, SURFACTANTS,
1507 PRODUCTION, ONSHORE IMPACTS, OFFSHORE DRILLING, SOCIO-ECONOMIC EFFECTS,
1516 PRODUCTION, MODELS, GROUNDWATER, ENVIRONMENTAL EFFECTS, *TERTIARY OIL RECOVERY METHODS, WATER QUALITY,
1525 PRODUCTION, OIL INDUSTRY, ENVIRONMENTAL EFFECTS, SOCIO-ECONOMIC EFFECTS, SCOTLAND, *SULLOM VOE,
1537 PRODUCTION, OIL SHALE, ENVIRONMENTAL EFFECTS, ECONOMICS, DEVELOPMENT,
1609 PRODUCTION, LEGISLATION, EPA, US, WATER QUALITY, *UNDERGROUND INJECTION,
1035 PUGET SOUND, OIL SPILLS, NOAA, MONITORING, MOLLUSKS, ENVIRONMENTAL EFFECTS, BASELINE STUDIES, SEDIMENTS,
1094 PUGET SOUND, MARINE ORGANISMS, HYDROCARBONS, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, SEDIMENTS, SPECTROSCOPY, WASHINGTON,
1202 PUGET SOUND, OIL TRANSPORT, OIL SPILLS, LEGISLATION, TANKERS, WASHINGTON,
1244 RECLAMATION, PATENT, LUBRICATING OIL, WASTE OIL TREATMENT,
1250 RECLAMATION, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, DISPOSAL, WASTE OIL, SOURCES,
1255 RECLAMATION, DISPOSAL, WASTE OIL TREATMENT, USN,
1308 RECLAMATION, INDUSTRIES, DESIGN-ENGINEERING, WASTE OIL,
1310 RECLAMATION, LUBRICATING OIL, WASTE OIL TREATMENT, *BERC/ERDA SOLVENT,
1311 RECLAMATION, PATENT, LUBRICATING OIL, SURFACTANTS,
1312 RECLAMATION, LUBRICATING OIL, WASTE OILS, *REREFINING PROCESS,
1313 RECLAMATION, PATENT, LUBRICATING OIL, FILTRATION, WASTE OIL,
1314 RECLAMATION, FUEL OIL, WASTEWATER TREATMENT, WASTE OIL, REUSE, *MEMBRANE TECHNIQUES,
1316 RECLAMATION, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, CONSERVATION, WASTE OIL, UK,
1317 RECLAMATION, LUBRICATING OIL, GOVERNMENT AGENCIES, WASTE OIL, REFINING, REUSE,
1319 RECLAMATION, PRECIPITATION, PATENT, LUBRICATING OIL, FLOCCULATION, WASTE OIL TREATMENT, SURFACTANTS,
1320 RECLAMATION, PATENT, LUBRICATING OIL, WASTE OIL, REFINING,
1297 RECYCLING, OIL-WATER SEPARATION, GERMANY, WEST, REFINERIES, WASTEWATER TREATMENT, SLUDGE,
1305 RECYCLING, OIL-WATER SEPARATION, DISPOSAL, WASTE OIL, SLUDGE,
1315 RECYCLING, LUBRICATING OIL, ENGLAND, WASTE OIL,
1318 RECYCLING, OIL-WATER SEPARATION, DESIGN-ENGINEERING, WASTEWATER TREATMENT,
1602 RECYCLING, LEGISLATION, WASTE OIL, STATE GOVERNMENTS, *LOCAL GOVERNMENTS,
1369 RED SEA, CRUDE OIL, CORALS, ACUTE EFFECTS, TOXICITY, *HETEROXENIA FUSCESCENS,
1028 REFINERIES, INFORMATION SYSTEMS, INDUSTRIES, ECONOMIC EFFECTS, CONTAMINATION, WASTEWATERS, SOURCES,
1055 REFINERIES, MONITORING, WASTE OIL, SAMPLING, WASTEWATERS,
1067 REFINERIES, MONITORING, CHEMICAL ANALYSIS, AROMATIC HYDROCARBONS, WASTEWATERS, *COLORIMETRY,

1084 REFINERIES, HYDROCARBONS, CONTAMINATION, BEACHES, SAMPLING, SEDIMENTS,
1086 REFINERIES, POLAND, PETROCHEMICALS, PAH, HEALTH HAZARS, SAMPLING, SOIL, *AGRICULTURE,
1090 REFINERIES, MONITORING, ANALYTICAL TECHNIQUES, WASTEWATERS, TOXICITY,
1092 REFINERIES, PETROCHEMICALS, MEXICO/GULF OF, HYDROCARBONS, CHEMICAL ANALYSIS, SAMPLING, SOURCES, *MISSISSIPPI DELTA,
1233 REFINERIES, OIL-WATER SEPARATION, DESIGN-ENGINEERING, WASTEWATER TREATMENT, SHIPS,
1238 REFINERIES, POLLUTION CONTROL, PETROCHEMICALS, OIL INDUSTRY, MANUALS, WASTEWATER TREATMENT,
1240 REFINERIES, INCINERATION, DISPOSAL, DESIGN-ENGINEERING, SLUDGE, *FLUID BED INCINERATION,
1241 REFINERIES, WASTEWATER TREATMENT,
1251 REFINERIES, OIL-WATER SEPARATION, FLOTATION, FLOCCULATION, COALESCENCE, WASTEWATER TREATMENT, *OZONATION,
1259 REFINERIES, OXIDATION, WASTEWATER TREATMENT, *OXYGEN AERATION,
1261 REFINERIES, DISPOSAL, SLUDGE, WASTEWATER TREATMENT, *SLUDGE DEWATERING,
1268 REFINERIES, INCINERATION, WASTEWATER TREATMENT, SLUDGE, USSR,
1270 REFINERIES, PETROCHEMICALS, WASTEWATER TREATMENT, *PHYSICAL-CHEMICAL METHODS,
1272 REFINERIES, PATENT, OXIDATION, ACTIVATED SLUDGE, WASTEWATER TREATMENT,
1280 REFINERIES, PETROCHEMICALS, WASTEWATER TREATMENT, *BIOCHEMICAL PURIFICATION,
1289 REFINERIES, ACTIVATED SLUDGE, WASTEWATERS, SOURCES, WASTEWATER TREATMENT, *OXIDATION LAGOONS, *ACTIVATED CARBON,
1290 REFINERIES, DISPOSAL, CONTAMINANTS, CHEMICAL ANALYSIS, WASTEWATER TREATMENT,
1293 REFINERIES, WASTEWATER TREATMENT, *OZONE AERATION, *BIOCHEMICAL PURIFICATION,
1297 REFINERIES, RECYCLING, OIL-WATER SEPARATION, GERMANY, WEST, WASTEWATER TREATMENT, SLUDGE,
1298 REFINERIES, POLLUTION CONTROL, PATENT, INDUSTRIES, WASTEWATER TREATMENT, SPILL CLEANUP,
1299 REFINERIES, OIL-WATER SEPARATION, FLOTATION, EMULSIONS, WASTEWATER TREATMENT, SKIMMERS,
1301 REFINERIES, WASTEWATER TREATMENT, SLUDGE, *ACID PRETREATMENT,
1303 REFINERIES, PATENT, OIL-WATER SEPARATION, EMULSIONS, WASTEWATER TREATMENT, *POLYVINYL CHLORIDE,
1338 REFINERIES, POLLUTION PREVENTION, PETROCHEMICALS, FUELS, WASTEWATER TREATMENT,
1357 REFINERIES, PORTS, OIL SPILLS, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, WASTEWATERS, UK, *MILFORD HAVEN,
1358 REFINERIES, PORTS, OIL SPILLS, MONITORING, BIOLOGICAL EFFECTS, WASTEWATERS, UK, *MILFORD HAVEN, *OIL POLLUTION RESEARCH UNIT,
1359 REFINERIES, MARSHES, BIOLOGICAL EFFECTS, WASTEWATERS, SHORELINES, VEGETATION, UK,
1371 REFINERIES, MARSHES, BIOLOGICAL EFFECTS, WASTEWATERS, VEGETATION, UK, *SALTMARSH,
1392 REFINERIES, PHYTOPLANKTON, MARINE ORGANISMS, FRANCE, ENVIRONMENTAL EFFECTS, BIODEGRADATION, BACTERIA, WASTEWATERS,
1398 REFINERIES, FRESHWATER, FISH, ACUTE EFFECTS, TOXICITY, WASTEWATERS, *REDEAR SUNFISH,
1440 REFINERIES, POLLUTION CONTROL, MODELS, ECONOMIC EFFECTS, WASTEWATERS, *INDUSTRY COSTS,
1457 REFINERIES, OIL SPILLS, MONITORING, DISPERSANTS, CONTAMINATION, TOXICITY, *BOOK REVIEW,
1509 REFINERIES, PETROCHEMICALS, OIL INDUSTRY, ENVIRONMENTAL EFFECTS, DEVELOPMENT,
1511 REFINERIES, INDUSTRIES, ENVIRONMENTAL EFFECTS, *ENERGY CONSERVATION, *TECHNOLOGY INNOVATION,
1621 REFINERIES, POLLUTION CONTROL, MONITORING, GUIDELINES, CANADA, WASTEWATERS, REGULATIONS,
1279 REFINING, PETROLEUM PRODUCTS, PETROCHEMICALS, CONTAMINATION, WASTE OIL, RIVERS, USSR,
1317 REFINING, RECLAMATION, LUBRICATING OIL, GOVERNMENT AGENCIES, WASTE OIL, REUSE,
1320 REFINING, RECLAMATION, PATENT, LUBRICATING OIL, WASTE OIL,
1342 REFINING, POLLUTION PREVENTION, OIL TRANSPORT, OIL SPILLS, OIL INDUSTRY, ENVIRONMENTAL EFFECTS,
1145 REGULATIONS, POLLUTION PREVENTION, SPILL CLEANUP, SAFETY, USCG,
1205 REGULATIONS, POLLUTION CONTROL, ENVIRONMENTAL PROTECTION, COST ANALYSIS, TANKERS, SEGREGATED BALLAST, USCG,
1221 REGULATIONS, POLLUTION PREVENTION, MONITORING, IMCO, SHIPS,
1330 REGULATIONS, POLLUTION CONTROL, OIL DISCHARGES, MONITORING, IMCO, TANKERS, *BAILEY MONITOR PROGRAM,
1331 REGULATIONS, POLLUTION PREVENTION, OIL DISCHARGES, EPA, DRILLING, CONTINGENCY PLANNING, *NAVIGABLE WATERS,
1347 REGULATIONS, OIL SPILLS, OFFSHORE DEVELOPMENT, INFORMATION SYSTEMS, DESIGN-ENGINEERING, SAFETY, *OCEAN TECHNOLOGY,
1459 REGULATIONS, FATE, ENVIRONMENTAL EFFECTS, CONTAMINANTS, BIOLOGICAL EFFECTS, *BOOK REVIEW,
1512 REGULATIONS, PORTS, OIL DISCHARGES, ENVIRONMENTAL EFFECTS, EIS, SAFETY, *DEEPWATER PORT,
1513 REGULATIONS, PLATFORMS, OIL INDUSTRY, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS,
1529 REGULATIONS, PORTS, OFFSHORE DEVELOPMENT, LIABILITY, INSURANCE, SHIPS,
1601 REGULATIONS, OIL TRANSFER, NEW JERSEY, LEGISLATION, COMPENSATION, SPILL CLEANUP, STATE GOVERNMENTS,
1612 REGULATIONS, OFFSHORE DEVELOPMENT, NORWAY, NORTH SEA, LIABILITY,
1614 REGULATIONS, POLLUTION CONTROL, INTERNATIONAL CONVENTIONS, TANKERS, SEGREGATED BALLAST,
1616 REGULATIONS, POLLUTION CONTROL, OFFSHORE DEVELOPMENT, NORTH SEA, LIABILITY, INTERNATIONAL CONVENTIONS, EUROPE,
1621 REGULATIONS, REFINERIES, POLLUTION CONTROL, MONITORING, GUIDELINES, CANADA, WASTEWATERS,

1622 REGULATIONS, OIL TRANSPORT, LIABILITY, TANKERS, SAFETY, USCG,
1058 RELEASE, MONITORING, MOLLUSKS, METABOLISM, MANUALS, HYDROCARBONS, UPTAKE,
1063 RELEASE, MONITORING, INTERTIDAL ZONE, CRUDE OIL, ALASKA, SEDIMENTS, UPTAKE, *PORT VALDEZ,
1362 RELEASE, PETROLEUM PRODUCTS, PAH, FISH, UPTAKE, *3,4-BENZOPYRENE,
1377 RELEASE, METABOLISM, HYDROCARBONS, FISH, CRUSTACEANS, UPTAKE, *LABELED N-ALKANES,
1396 RELEASE, HYDROCARBONS, FISH, CRUSTACEANS, BIOLOGICAL EFFECTS, ALASKA, UPTAKE, *BIOTRANSFORMATION,
1416 RELEASE, POLYCHAETES, FUEL OIL, AROMATIC HYDROCARBONS, UPTAKE, *NAPHTHALENE, *NEANTHES ARENACEODENTATA,
1448 RELEASE, OFFSHORE DEVELOPMENT, MICROORGANISMS, ENVIRONMENTAL EFFECTS, CRUDE OIL, SEDIMENTS, *TRACE METALS,
1455 RELEASE, HYDROCARBONS, FISH, UPTAKE, *BENZENE, *NORTHERN ANCHOVY, *STRIPED BASS,
1071 REMOTE SENSING, OIL SLICKS, DETECTION, USGS, *LANDSAT IMAGERY,
1072 REMOTE SENSING, OIL SPILLS, OFFSHORE DEVELOPMENT, OCS, FATE, ENVIRONMENTAL EFFECTS, CONTINGENCY PLANNING, ALASKA,
1073 REMOTE SENSING, CONTAMINANTS, BALTIC SEA, *WIND EFFECTS, *WAVE EFFECTS,
1074 REMOTE SENSING, OIL SLICKS, DESIGN-ENGINEERING, SURVEILLANCE,
1075 REMOTE SENSING, OIL SLICKS, OCEANS, DETECTION, DESIGN-ENGINEERING,
1076 REMOTE SENSING, OIL SLICKS, SEAWATER, *LIDAR ENERGETICS,
1077 REMOTE SENSING, OIL SLICKS, MOVEMENT, MONITORING, *SATELLITE-AIRCRAFT-DROGUE STUDIES,
1078 REMOTE SENSING, OCS, ESTUARIES, DISPERSIONS, WASTEWATERS, *CURRENT CIRCULATION,
1079 REMOTE SENSING, OIL SLICKS, OCEANS, DETECTION, *LASERS,
1080 REMOTE SENSING, POLLUTION PREVENTION, OIL SPILLS, MODELS, DETECTION, COASTS, *LINEAR PROGRAMMING,
1517 RESOURCE MANAGEMENT, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, COASTS, *CONFERENCES, *COASTAL IMPACTS,
1015 RESTORATION, OIL SLICKS, ENGLAND, CONTAMINATION, COASTS, BIRDS,
1173 RESTORATION, ENVIRONMENTAL EFFECTS, COASTS, CANADA, SPILL CLEANUP,
1197 RESTORATION, OIL SPILLS, BIRDS, SOLVENTS,
1198 RESTORATION, OLYMPIC GAMES SPILL, OIL SPILLS, CONTAMINATION, BIRDS, TORREY CANYON,
1199 RESTORATION, PERSONNEL TRAINING, OLYMPIC GAMES SPILL, BIRDS,
1336 RESTORATION, POLLUTION CONTROL, OIL WELLS, DISPOSAL, BEAUFORT SEA, BEACHES, SPILL CLEANUP,
1527 RESTORATION, OIL SHALE, EXTRACTION, EIS, DISPOSAL, COLORADO, SOLID WASTES,
1314 REUSE, RECLAMATION, FUEL OIL, WASTEWATER TREATMENT, WASTE OIL, *MEMBRANE TECHNIQUES,
1317 REUSE, REFINING, RECLAMATION, LUBRICATING OIL, GOVERNMENT AGENCIES, WASTE OIL,
1304 RHINE RIVER, MONITORING, BILGES, WASTE OIL DISPOSAL, TANKERS, *COMPUTER SURVEILLANCE,
1182 RIVERS, PATENT, ABSORPTION, SPILL CLEANUP, WASTE OIL, SEAWATER,
1194 RIVERS, ICE, CANADA, BOOMS, SPILL CONTAINMENT, SPILL RECOVERY, *ST. CLAIR & DETROIT RIVERS,
1279 RIVERS, REFINING, PETROLEUM PRODUCTS, PETROCHEMICALS, CONTAMINATION, WASTE OIL, USSR,
1460 RIVERS, OIL TRANSFER, IRAQ, CONTAMINATION, WASTE OIL, TANKERS, *SHATT AL-ARAB,
1569 RIVERS, ICE, CRUDE OIL, COALESCENCE, BEHAVIOR, SPREADING, EMUSIFICATION,
1578 RIVERS, HYDROCARBONS, FRANCE, FLOCCULATION, SEDIMENTATION, *GULF OF LION,
1589 RIVERS, CONTAMINATION, BIODEGRADATION, SEDIMENTS, *PARRAMATTA RIVER, *MUDS,
1010 SAFETY, POLLUTION PREVENTION, TANKERS, US, *LIBERIAN REGISTRY LAWS,
1145 SAFETY, REGULATIONS, POLLUTION PREVENTION, SPILL CLEANUP, USCG,
1147 SAFETY, OFFSHORE DEVELOPMENT, NORWAY, NORTH SEA, ENVIRONMENTAL PROTECTION, ECONOMICS, SPILL CLEANUP,
1226 SAFETY, MEXICO/GULF OF, LIABILITY, CONTINGENCY PLANNING, ARGO MERCHANT SPILL, TANKERS, USCG, *FLAGS OF CONVENIENCE,
1332 SAFETY, POLLUTION PREVENTION, OIL WELLS, OIL TRANSPORT, OFFSHORE DRILLING, OCS, HEALTH HAZARDS,
1347 SAFETY, REGULATIONS, OIL SPILLS, OFFSHORE DEVELOPMENT, INFORMATION SYSTEMS, DESIGN-ENGINEERING, *OCEAN TECHNOLOGY,
1512 SAFETY, REGULATIONS, PORTS, OIL DISCHARGES, ENVIRONMENTAL EFFECTS, EIS, *DEEPWATER PORT,
1528 SAFETY, POLLUTION PREVENTION, OFFSHORE PRODUCTION, ENVIRONMENTAL PROTECTION, ECONOMICS,
1605 SAFETY, OIL SPILLS, LIABILITY, LEGISLATION, TANKERS, US, *CONGRESSIONAL BILLS,
1620 SAFETY, PETROLEUM PRODUCTS, OIL TRANSFER, GUIDELINES, CRUDE OIL, TANKERS, *TERMINALS,
1622 SAFETY, REGULATIONS, OIL TRANSPORT, LIABILITY, TANKERS, USCG,
1623 SAFETY, PLANTS, OIL INDUSTRY, HEALTH HAZARDS, GUIDELINES, STORAGE, *BULK PETROLEUM
1055 SAMPLING, REFINERIES, MONITORING, WASTE OIL, WASTEWATERS,
1081 SAMPLING, PATENT, OIL SLICKS, DESIGN-ENGINEERING, SURFACTANTS,
1082 SAMPLING, OFFSHORE DRILLING, MICROORGANISMS, DISTRIBUTION, BIOLOGICAL EFFECTS, ATLANTIC COAST, SEAWATER, SEDIMENTS,
1083 SAMPLING, OCEANS, HYDROCARBONS, FATE,
1084 SAMPLING, REFINERIES, HYDROCARBONS, CONTAMINATION, BEACHES, SEDIMENTS,
1085 SAMPLING, OIL SPILLS, OCS, MISSISSIPPI, HYDROCARBONS, ESTUARIES, ALABAMA, SEDIMENTS, TOXICITY,
1086 SAMPLING, REFINERIES, POLAND, PETROCHEMICALS, PAH, HEALTH HAZARDS, SOIL, *AGRICULTURE,
1087 SAMPLING, CARIBBEAN SEA, ATLANTIC OCEAN, TAR,
1088 SAMPLING, PLANKTON, HYDROCARBONS, FISH, CHEMICAL ANALYSIS, BEAUFORT SEA, SEAWATER,

SEDIMENTS, SOURCES,
1092 SAMPLING, REFINERIES, PETROCHEMICALS, MEXICO/GULF OF, HYDROCARBONS, CHEMICAL ANALYSIS, SOURCES, *MISSISSIPPI DELTA,
1096 SAMPLING, POLLUTION CONTROL, OIL INDUSTRY, ANALYTICAL TECHNIQUES, WATER QUALITY, WASTEWATERS, *ON-LINE INSTRUMENTATION,
1365 SAMPLING, PLANTS, OIL SPILLS, MARSHES, BIOLOGICAL EFFECTS, *SPECIES REDUCTION,
1553 SAMPLING, MICROORGANISMS, CRUDE OIL, BIOLOGICAL EFFECTS, BIODEGRADATION, BEAUFORT SEA,
1554 SAMPLING, MICROORGANISMS, HYDROCARBONS, CRUDE OIL, BIODEGRADATION, ATLANTIC OCEAN,
1563 SAMPLING, OFFSHORE DRILLING, MICROORGANISMS, CRUDE OIL, BIODEGRADATION, ATLANTIC COAST, *OIL DEVELOPMENT SITES,
1352 SANTA BARBARA CHANNEL, NATURAL SEEPAGE, MARINE ORGANISMS, HYDROCARBONS, CHRONIC EFFECTS,
1108 SCOTLAND, OIL SPILLS, NORTH SEA, BEACHES,
1525 SCOTLAND, PRODUCTION, OIL INDUSTRY, ENVIRONMENTAL EFFECTS, SOCIO-ECONOMIC EFFECTS, *SULLOM VOE,
1051 SEAWATER, MONITORING, HYDROCARBONS, CRUSTACEANS, *MOTOR BEHAVIOR,
1076 SEAWATER, REMOTE SENSING, OIL SLICKS, *LIDAR ENERGETICS,
1082 SEAWATER, SAMPLING, OFFSHORE DRILLING, MICROORGANISMS, DISTRIBUTION, BIOLOGICAL EFFECTS, ATLANTIC COAST, SEDIMENTS,
1088 SEAWATER, SAMPLING, PLANKTON, HYDROCARBONS, FISH, CHEMICAL ANALYSIS, BEAUFORT SEA, SEDIMENTS, SOURCES,
1112 SEAWATER, PETROLEUM PRODUCTS, DETECTION, ANALYTICAL TECHNIQUES, *NAPHTHENIC ACIDS,
1124 SEAWATER, OIL SPILLS, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, SPECTROSCOPY,
1182 SEAWATER, RIVERS, PATENT, ABSORPTION, SPILL CLEANUP, WASTE OIL,
1461 SEDIMENTATION, OIL SPILLS, ENVIRONMENTAL EFFECTS, BENTHOS, *ANIMAL-SEDIMENT RELATIONSHIPS,
1578 SEDIMENTATION, RIVERS, HYDROCARBONS, FRANCE, FLOCCULATION, *GULF OF LION,
1032 SEDIMENTS, MONITORING, MARINE ORGANISMS, DISTRIBUTION, BENTHOS, UK, *SUBLITTORAL MACROFAUNA, *MILFORD HAVEN,
1035 SEDIMENTS, PUGET SOUND, OIL SPILLS, NOAA, MONITORING, MOLLUSKS, ENVIRONMENTAL EFFECTS, BASELINE STUDIES,
1063 SEDIMENTS, RELEASE, MONITORING, INTERTIDAL ZONE, CRUDE OIL, ALASKA, UPTAKE, *PORT VALDEZ,
1082 SEDIMENTS, SEAWATER, SAMPLING, OFFSHORE DRILLING, MICROORGANISMS, DISTRIBUTION, BIOLOGICAL EFFECTS, ATLANTIC COAST,
1084 SEDIMENTS, SAMPLING, REFINERIES, HYDROCARBONS, CONTAMINATION, BEACHES,
1085 SEDIMENTS, SAMPLING, OIL SPILLS, OCS, MISSISSIPPI, HYDROCARBONS, ESTUARIES, ALABAMA, TOXICITY,
1088 SEDIMENTS, SEAWATER, SAMPLING, PLANKTON, HYDROCARBONS, FISH, CHEMICAL ANALYSIS, BEAUFORT SEA, SOURCES,
1091 SEDIMENTS, OFFSHORE PRODUCTION, CHEMICAL ANALYSIS,
1094 SEDIMENTS, PUGET SOUND, MARINE ORGANISMS, HYDROCARBONS, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, SPECTROSCOPY, WASHINGTON,
1102 SEDIMENTS, PETROLEUM PRODUCTS, HYDROCARBONS, FLORIDA, COASTS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, BIODEGRADATION, BACTERIA,
1108 SEDIMENTS, PORTS, PETROLEUM PRODUCTS, OCEANS, CONTAMINATION, CHEMICAL ANALYSIS, USSR,
1117 SEDIMENTS, PAH, LAKES, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, SPECTROMETRY,
1121 SEDIMENTS, LAKES, CHROMATOGRAPHY, AROMATIC HYDROCARBONS, ANALYTICAL TECHNIQUES, SPECTROSCOPY, *FLUORESCENCE,
1126 SEDIMENTS, PAH, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, SOURCES, SPECTROMETRY, *AQUATIC ENVIRONMENT,
1131 SEDIMENTS, PETROLEUM PRODUCTS, PAH, HYDROCARBONS, CRUDE OIL, SOURCE IDENTIFICATION, SOIL,
1409 SEDIMENTS, CRUSTACEANS, CRUDE OIL, BIOLOGICAL EFFECTS, BENTHOS, ARCTIC, *AMPHIPODS, *ISOPODS,
1426 SEDIMENTS, MOLLUSKS, CRUDE OIL, BIOLOGICAL EFFECTS, ALASKA, *CLAMS, *INDICATOR SPECIES, *MACOMA BALTHICA,
1448 SEDIMENTS, RELEASE, OFFSHORE DEVELOPMENT, MICROORGANISMS, ENVIRONMENTAL EFFECTS, CRUDE OIL, *TRACE METALS,
1491 SEDIMENTS, OFFSHORE DEVELOPMENT, OCS, MONITORING, ENVIRONMENTAL EFFECTS, BENTHOS, BASELINE STUDIES, ALASKA,
1560 SEDIMENTS, COASTS, BLACK SEA, BIODEGRADATION, BACTERIA, *COASTAL WATERS, USSR,
1567 SEDIMENTS, MICROORGANISMS, CHESAPEAKE BAY, BIODEGRADATION, BACTERIA, AROMATIC HYDROCARBONS ,
1589 SEDIMENTS, RIVERS, CONTAMINATION, BIODEGRADATION, *PARRAMATTA RIVER, *MUDS,
1205 SEGREGATED BALLAST, REGULATIONS, POLLUTION CONTROL, ENVIRONMENTAL PROTECTION, COST ANALYSIS, TANKERS, USCG,
1614 SEGREGATED BALLAST, REGULATIONS, POLLUTION CONTROL, INTERNATIONAL CONVENTIONS, TANKERS,
1030 SHIPS, OIL SPILLS, TANKERS, SOURCES,
1036 SHIPS, OIL DISCHARGES, MONITORING, BILGES, BALLAST,
1065 SHIPS, MONITORING, FUEL OIL, DETECTION, DESIGN-ENGINEERING, BILGES, *OIL-IN-WATER DETECTOR,
1184 SHIPS, PATENT, DESIGN-ENGINEERING, SKIMMERS, *WAVE DAMPING DEVICE,
1201 SHIPS, OIL DISCHARGES, OCEANS, HARBORS, *MERCHANT SHIPS,

1204 SHIPS, OIL TRANSFER, DESIGN-E_GINEERING, RCTIC, *PUMPS, *ADAPTS,
1221 SHIPS,REGULATIONS, POLLUTION PREVENTION, MONITORING, IMCO,
1233 SHIPS, REFINERIES, OIL-WATER SEPARATION, DESIGN-ENGINEERING, WASTEWATER TREATMENT,
1273 SHIPS, OIL-WATER SEPARATION, EMULSIONS, BILGES, WASTEWATER TREATMENT, *DEMULSIFICATION,
1326 SHIPS, POLLUTION PREVENTION, LEAKAGE, *STERN GEAR SYSTEM,
1346 SHIPS, POLLUTION CONTROL, OIL SPILLS, LAW ENFORCEMENT, HARBORS, UK, *MILFORD HAVEN,
1445 SHIPS, PORTS, POLLUTION CONTROL, OIL SPILLS, CHESAPEAKE BAY, *SYMPOSIUM,
1449 SHIPS, OIL DISCHARGES, FATE, DISPERSANTS, CONTAMINATION, BIOLOGICAL EFFECTS, TANKERS,
1529 SHIPS, REGULATIONS, PORTS, OFFSHORE DEVELOPMENT, LIABILITY, INSURANCE,
1607 SHIPS, OIL SPILLS, LEGISLATION, INTERNATIONAL AGREEMENTS, US, TANKERS, *LEGAL PROBLEMS,
1615 SHIPS, POLLUTION PREVENTION, LIABILITY, INTERNATIONAL CONVENTIONS, IMCO, HARBORS, COMPENSATION, COASTS,
1619 SHIPS, POLLUTION CONTROL, OIL-WATER SEPARATION, OIL DISCHARGES, LAW ENFORCEMENT, INTERNATIONAL CONVENTIONS,
1018 SHORELINES, PORTS, OIL TRANSFER, OIL SPILLS, ISRAEL, CONTAMINATION, SPILL CLEANUP, *EILAT OIL TERMINAL,
1355 SHORELINES, OIL SPILLS, ENVIRONMENTAL EFFECTS, ATLANTIC COAST, *WWII SPILLS,
1359 SHORELINES, REFINERIES, MARSHES, BIOLOGICAL EFFECTS, WASTEWATERS, VEGETATION, UK,
1140 SKIMMERS, PATENT, OIL SLICKS, DESIGN-ENGINEERING, BOOMS, SPILL CLEANUP,
1143 SKIMMERS, SPILL CLEANUP, SPILL RECOVERY, *STRAIT OF MALACCA,
1146 SKIMMERS, SPILL RECOVERY, *CLEAN SWEEP OIL SKIMMER,
1148 SKIMMERS, OIL-WATER SEPARATION, FUELS, DESIGN-ENGINEERING, SPILL RECOVERY, WASTE OIL,
1149 SKIMMERS, BOOMS, SPILL CLEANUP, *VIKOMA INTERNATIONAL,
1151 SKIMMERS, DESIGN-ENGINEERING, SPILL CLEANUP, *DYNAMIC INCLINED PLANE SKIMMER,
1154 SKIMMERS, DESIGN-ENGINEERING, ABSORPTION, SPILL RECOVERY,
1158 SKIMMERS, PATENT, DESIGN-ENGINEERING, SPILL CLEANUP,
1166 SKIMMERS, PATENT, DESIGN-ENGINEERING, CONTAMINANTS, SPILL RECOVERY,
1167 SKIMMERS, PATENT, DESIGN-ENGINEERING, SPILL RECOVERY,
1169 SKIMMERS, DESIGN-ENGINEERING, SPILL RECOVERY, *OELA-III SKIMMER,
1172 SKIMMERS, MODELS, BOOMS, SPILL CONTAINMENT, SPILL CLEANUP, *HYDRODYNAMIC PROBLEMS,
1174 SKIMMERS, PATENT, OIL-WATER SEPARATION, SPILL CLEANUP,
1177 SKIMMERS, PATENT, ABSORPTION, SPILL RECOVERY, *ABSORBENT POWDER,
1184 SKIMMERS, SHIPS, PATENT, DESIGN-ENGINEERING, *WAVE DAMPING DEVICE,
1188 SKIMMERS, ICE, FRESHWATER, CRUDE OIL, ARCTIC, SPILL RECOVERY, *LOCKHEED CLEAN SWEEP,
1189 SKIMMERS, DESIGN-ENGINEERING, SPILL RECOVERY, *SLURP WEIR SKIMMER,
1196 SKIMMERS, PATENT, DESIGN-ENGINEERING, BOOMS, SPILL CLEANUP,
1235 SKIMMERS, OIL-WATER SEPARATION, INLAND, DESIGN-ENGINEERING, WASTEWATERS, *AFL INDUSTRIES,
1299 SKIMMERS, REFINERIES, OIL-WATER SEPARATION, FLOTATION, EMULSIONS, WASTEWATER TREATMENT,
1344 SKIMMERS, POLLUTION CONTROL, BOOMS, SPILL CLEANUP,
1345 SKIMMERS, POLLUTION CONTROL, CANADA, SPILL RECOVERY, *EQUIPMENT TESTING,
1229 SLUDGE, OIL-WATER SEPARATION, EMULSIONS, WASTEWATER TREATMENT,
1240 SLUDGE, REFINERIES, INCINERATION, DISPOSAL, DESIGN-ENGINEERING, *FLUID BED INCINERATION,
1261 SLUDGE, REFINERIES, DISPOSAL, WASTEWATER TREATMENT, *SLUDGE DEWATERING,
1268 SLUDGE, REFINERIES, INCINERATION, WASTEWATER TREATMENT, USSR,
1276 SLUDGE, INCINERATION, DISPOSAL, DESIGN-ENGINEERING, COST ANALYSIS, SOLID WASTES,
1287 SLUDGE, PH CONTROL, FLOTATION, EMULSIONS, WASTEWATER TREATMENT, COAGULATION, *AERATION,
1297 SLUDGE, REFINERIES, RECYCLING, OIL-WATER SEPARATION, GERMANY, WEST, WASTEWATER TREATMENT,
1301 SLUDGE, REFINERIES, WASTEWATER TREATMENT, *ACID PRETREATMENT,
1305 SLUDGE, RECYCLING, OIL-WATER SEPARATION, DISPOSAL, WASTE OIL,
1541 SOCIAL EFFECTS, OFFSHORE DEVELOPMENT, ECONOMIC EFFECTS, ALASKA,
1222 SOCIO-ECONOMIC EFFECTS, OIL TRANSFER, OFFSHORE DEVELOPMENT, MODELS, ENVIRONMENTAL EFFECTS, COST ANALYSIS, SPREADING,
1507 SOCIO-ECONOMIC EFFECTS, PRODUCTION, ONSHORE IMPACTS, OFFSHORE DRILLING,
1525 SOCIO-ECONOMIC EFFECTS, SCOTLAND, PRODUCTION, OIL INDUSTRY, ENVIRONMENTAL EFFECTS, *SULLOM VOE,
1535 SOCIO-ECONOMIC EFFECTS, PORTS, ONSHORE IMPACTS, OFFSHORE DEVELOPMENT, NEW JERSEY, DELAWARE, COASTS,
1086 SOIL, SAMPLING, REFINERIES, POLAND, PETROCHEMICALS, PAH, HEALTH HAZARDS, *AGRICULTURE,
1131 SOIL, SEDIMENTS, PETROLEUM PRODUCTS, PAH, HYDROCARBONS, CRUDE OIL, SOURCE IDENTIFICATION,
1160 SOIL, PATENT, MICROORGANISMS, BIODEGRADATION, SPILL DISPOSAL,
1181 SOIL, CONTAMINATION, *OIL REMOVAL, *DETERGENTS,
1394 SOIL, FUNGI, CRUDE OIL, BIOLOGICAL EFFECTS, BIODEGRADATION, WASTE OIL,
1276 SOLID WASTES, SLUDGE, INCINERATION, DISPOSAL, DESIGN-ENGINEERING, COST ANALYSIS,
1288 SOLID WASTES, OIL INDUSTRY, INDUSTRIES, DISPOSAL, WASTEWATERS,
1309 SOLID WASTES, WASTE OIL TREATMENT, *ENERGY SOURCES,
1527 SOLID WASTES, RESTORATION, OIL SHALE, EXTRACTION, EIS, DISPOSAL, COLORADO,
1573 SOLUBILITY, OIL SPILLS, ICE, BEHAVIOR, ARCTIC, ABSORPTION, SPREADING, CLEANUP,
1572 SOLUTION, OIL SPILLS, MODELS, HYDROCARBONS, EVAPORATION, CRUDE OIL, TOXICITY,
1095 SOLVENTS, HYDROCARBONS, EXTRACTION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SPECTROMETRY,
1105 SOLVENTS, PETROLEUM PRODUCTS, EXTRACTION, ANALYTICAL TECHNIQUES, *GRAVIMETRIC DETERMINATION,

1193 SOLVENTS, PHYTOPLANKTON, EMULSIFIERS, SURFACTANTS, TOXICITY,
1197 SOLVENTS, RESTORATION, OIL SPILLS, BIRDS,
1433 SOLVENTS, FISH, DISPERSANTS, ACUTE EFFECTS, TOXICITY, *FISH LARVAE,
1119 SOURCE IDENTIFICATION, CRUDE OIL, CHEMICAL ANALYSIS, API,
1123 SOURCE IDENTIFICATION, HYDROCARBONS, CRUDE OIL, CHROMATOGRAPHY, CHEMICAL ANALYSIS,
1124 SOURCE IDENTIFICATION, SEAWATER, OIL SPILLS, CHEMICAL ANALYSIS, SPECTROSCOPY,
1125 SOURCE IDENTIFICATION, CRUDE OIL, ANALYTICAL TECHNIQUES, *LUMINESCENCE CONTOUR SPECTRA,
1126 SOURCE IDENTIFICATION, SEDIMENTS, PAH, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SOURCES, SPECTROMETRY, *AQUATIC ENVIRONMENT,
1127 SOURCE IDENTIFICATION, CRUDE OIL, CHEMICAL ANALYSIS, *FLUOROMETRY,
1128 SOURCE IDENTIFICATION, STATISTICAL ANALYSIS, ANALTYTICAL TECHNIQUES, SPECTROMETRY,
1129 SOURCE IDENTIFICATION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, *TAR BALLS, SAMPLING, CRUDE OIL, WEATHERING, ISRAEL, MEDITERRANEAN SEA,
1130 SOURCE IDENTIFICATION, OIL SPILLS, ANALYTICAL TECHNIQUES, SPECTROSCOPY, SPECTROMETRY, *US BUREAU OF MINES,
1131 SOURCE IDENTIFICATION, SOIL, SEDIMENTS, PETROLEUM PRODUCTS, PAH, HYDROCARBONS, CRUDE OIL,
1343 SOURCE IDENTIFICATION, POLLUTION PREVENTION, LAW ENFORCEMENT, SPILL CLEANUP, SURVEILLANCE, USCG,
1625 SOURCE IDENTIFICATION, OIL SPILLS, OIL INDUSTRY, MARINE ORGANISMS, HYDROCARBONS, CHEMICAL ANALYSIS, BIBLIOGRAPHIES,
1016 SOURCES, ITALY, HYDROCARBONS, CONTAMINATION, WASTEWATERS, *GULF OF TRIESTE,
1028 SOURCES, REFINERIES, INFORMATION SYSTEMS, INDUSTRIES, ECONOMIC EFFECTS, CONTAMINATION, WASTEWATERS,
1030 SOURCES, SHIPS, OIL SPILLS, TANKERS,
1070 SOURCES, MONITORING, DISTRIBUTION, COASTS, BEAUFORT SEA, TAR,
1088 SOURCES, SEDIMENTS, SEAWATER, SAMPLING, PLANKTON, HYDROCARBONS, FISH, CHEMICAL ANALYSIS, BEAUFORT SEA,
1092 SOURCES, SAMPLING, REFINERIES, PETROCHEMICALS, MEXICO/GULF OF, HYDROCARBONS, CHEMICAL ANALYSIS, *MISSISSIPPI DELTA,
1126 SOURCES, SOURCE IDENTIFICATION, SEDIMENTS, PAH, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SPECTROMETRY, *AQUATIC ENVIRONMENT,
1203 SOURCES, PACIFIC OCEAN, OIL TRANSPORT, OIL DISCHARGES, MARINE ORGANISMS, FISHERIES, FATE, BIOLOGICAL EFFECTS,
1250 SOURCES, RECLAMATION, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, DISPOSAL, WASTE OIL,
1289 SOURCES, REFINERIES, ACTIVATED SLUDGE, WASTEWATERS, WASTEWATER TREATMENT, *OXIDATION LAGOONS, *ACTIVATED CARBON,
1150 SOUTH AFRICA, SPILL CLEANUP, MARINE ORGANISMS, DISPERSANTS, TOXICITY,
1152 SOUTH AFRICA, SPILL CLEANUP, POLLUTION CONTROL, DESIGN-ENGINEERING, *SALVAGE TUG,
1153 SOUTH AFRICA, SPILL CLEANUP, POLLUTION CONTROL, DESIGN-ENGINEERING, *SALVAGE TUG,
1453 SPAIN, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, DISPERSANTS, SPILL CLEANUP, URQUIOLA SPILL,
1049 SPECTROMETRY, MONITORING, DETECTION, BILGES, BALLAST, ANALYTICAL TECHNIQUES, WASTE OIL, *SUMMING LUMINESCENCE SPECTROMETRY,
1095 SPECTROMETRY, SOLVENTS, HYDROCARBONS, EXTRACTION, CHROMATOGRAPHY, CHEMICAL ANALYSIS,
1098 SPECTROMETRY, PAH, CRUDE OIL, CHROMATOGRAPHY, CHEMICAL ANALYSIS, CARCINOGENS,
1111 SPECTROMETRY, CONTAMINANTS, ANALYTICAL TECHNIQUES, *POLLUTANT CLASSIFICATION, *COMPUTER-SPECTROMETER SYSTEM,
1117 SPECTROMETRY, SEDIMENTS, PAH, LAKES, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES,
1126 SPECTROMETRY, SOURCES, SOURCE IDENTIFICATION, SEDIMENTS, PAH, CHROMATOGRAPHY, CHEMICAL ANALYSIS, *AQUATIC ENVIRONMENT,
1128 SPECTROMETRY, SOURCE IDENTIFICATION, STATISTICAL ANALYSIS, ANALTYTICAL TECHNIQUES,
1130 SPECTROMETRY, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, OIL SPILLS, CRUDE OIL, *U.S. BUREAU OF MINES,

1094 SPECTROSCOPY, SEDIMENTS, PUGET SOUND, MARINE ORGANISMS, HYDROCARBONS, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, WASHINGTON,
1121 SPECTROSCOPY, SEDIMENTS, LAKES, CHROMATOGRAPHY, AROMATIC HYDROCARBONS, ANALYTICAL TECHNIQUES, *FLUORESCENCE,
1124 SPECTROSCOPY, SOURCE IDENTIFICATION, SEAWATER, OIL SPILLS, CHEMICAL ANALYSIS,
1130 SPECTROSCOPY, SPECTROMETRY, SOURCE IDENTIFICATION, OIL SPILLS, ANALYTICAL TECHNIQUES, *US BUREAU OF MINES,
1007 SPILL CLEANUP, OIL SPILLS, NORWAY, NORTH SEA, *EKOFISK BLOWOUT,
1011 SPILL CLEANUP, OIL SPILLS, NORWAY, NORTH SEA, MONITORING, *EKOFISK BLOWOUT,
1018 SPILL CLEANUP, SHORELINES, PORTS, OIL TRANSFER, OIL SPILLS, ISRAEL, CONTAMINATION, *EILAT OIL TERMINAL,
1019 SPILL CLEANUP, PORTUGAL, TANKERS, *JAKOB MAERSK SPILL,
1022 SPILL CLEANUP, LIABILITY, FISHERIES, ENVIRONMENTAL EFFECTS, ARGO MERCHANT SPILL, TANKERS,
1023 SPILL CLEANUP, OIL SPILLS, MOVEMENT, JAPAN, FUEL OIL, ENVIRONMENTAL EFFECTS, *INLAND SEA,
1041 SPILL CLEANUP, MONITORING, GROUNDWATER, DESIGN-ENGINEERING, CONTAMINATION,
1122 SPILL CLEANUP, INFORMATION SYSTEMS, EPA, US, STATISTICAL ANALYSIS, USCG,
1140 SPILL CLEANUP, SKIMMERS, PATENT, OIL SLICKS, DESIGN-ENGINEERING, BOOMS,
1143 SPILL CLEANUP, SKIMMERS, SPILL RECOVERY, *STRAIT OF MALACCA,

1145 SPILL CLEANUP, SAFETY, REGULATIONS, POLLUTION PREVENTION, USCG,
1147 SPILL CLEANUP, SAFETY, OFFSHORE DEVELOPMENT, NORWAY, NORTH SEA, ENVIRONMENTAL PROTECTION, ECONOMICS,
1149 SPILL CLEANUP, SKIMMERS, BOOMS, *VIKOMA INTERNATIONAL,
1150 SPILL CLEANUP, MARINE ORGANISMS, DISPERSANTS, SOUTH AFRICA, TOXICITY,
1151 SPILL CLEANUP, SKIMMERS, DESIGN-ENGINEERING, *DYNAMIC INCLINED PLANE SKIMMER,
1152 SPILL CLEANUP, POLLUTION CONTROL, DESIGN-ENGINEERING, SOUTH AFRICA, *SALVAGE TUG,
1153 SPILL CLEANUP, POLLUTION CONTROL, DESIGN-ENGINEERING, SOUTH AFRICA, *SALVAGE TUG,
1158 SPILL CLEANUP, SKIMMERS, PATENT, DESIGN-ENGINEERING,
1159 SPILL CLEANUP, PATENT, EMULSIONS, DISPERSANTS, SURFACTANTS,
1163 SPILL CLEANUP, ENGLAND, DISPERSANTS, TOXICITY,
1164 SPILL CLEANUP, OCEANS,
1168 SPILL CLEANUP, DISPOSAL, ABSORPTION, *COTTON SORBENT,
1172 SPILL CLEANUP, SKIMMERS, MODELS, BOOMS, SPILL CONTAINMENT, *HYDRODYNAMIC PROBLEMS,
1173 SPILL CLEANUP, RESTORATION, ENVIRONMENTAL EFFECTS, COASTS, CANADA,
1174 SPILL CLEANUP, SKIMMERS, PATENT, OIL-WATER SEPARATION,
1175 SPILL CLEANUP, PATENT, OIL SLICKS, MICROORGANISMS, BIODEGRADATION, *NUTRIENT PARTICLES,
1182 SPILL CLEANUP, SEAWATER, RIVERS, PATENT, ABSORPTION, WASTE OIL,
1187 SPILL CLEANUP, PATENT, DISPERSIONS, *ASBESTOS MINE WASTES,
1196 SPILL CLEANUP, SKIMMERS, PATENT, DESIGN-ENGINEERING, BOOMS,
1298 SPILL CLEANUP, REFINERIES, POLLUTION CONTROL, PATENT, INDUSTRIES, WASTEWATER TREATMENT,
1323 SPILL CLEANUP, INDUSTRIES, GOVERNMENT AGENCIES, CONTINGENCY PLANNING, *OIL SPILL COOPERATIVES,
1324 SPILL CLEANUP, OIL DISCHARGES, LEGISLATION, DESIGN-ENGINEERING, CONTINGENCY PLANNING, US, SURVEILLANCE,
1325 SPILL CLEANUP, POLLUTION PREVENTION, FRANCE, CRUDE OIL, *POLMAR PLAN,
1327 SPILL CLEANUP, POLLUTION PREVENTION, OIL SPILLS, LIABILITY, COMPENSATION, *CONGRESSIONAL BILL,
1329 SPILL CLEANUP, POLLUTION PREVENTION, OIL TRANSPORT, OFFSHORE DRILLING, NORTH SEA, FATE, ENVIRONMENTAL EFFECTS, CRUDE OIL,
1336 SPILL CLEANUP, RESTORATION, POLLUTION CONTROL, OIL WELLS, DISPOSAL, BEAUFORT SEA, BEACHES,
1337 SPILL CLEANUP, POLLUTION CONTROL, MONITORING, DISPOSAL, DETECTION, BEAUFORT SEA, *EQUIPMENT EVALUATION,
1340 SPILL CLEANUP, DISPOSAL, DETECTION, BEHAVIOR, ARCTIC, *ARCTIC MARINE OIL SPILL PROGRAM,
1343 SPILL CLEANUP, SOURCE IDENTIFICATION, POLLUTION PREVENTION, LAW ENFORCEMENT, SURVEILLANCE, USCG,
1344 SPILL CLEANUP, SKIMMERS, POLLUTION CONTROL, BOOMS,
1451 SPILL CLEANUP, PORTS, POLLUTION PREVENTION, OIL TRANSFER, LEAKAGE, ENVIRONMENTAL EFFECTS, UK, *MILFORD HAVEN,
1453 SPILL CLEANUP, SPAIN, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, DISPERSANTS, URQUIOLA SPILL,
1523 SPILL CLEANUP, OFFSHORE DRILLING, MARINE ORGANISMS, ICE, ENVIRONMENTAL EFFECTS, BEAUFORT SEA, BASELINE STUDIES, ARCTIC,
1542 SPILL CLEANUP, POLLUTION PREVENTION, ONSHORE IMPACTS, OFFSHORE DEVELOPMENT, OCS, HABITAT, BIOLOGICAL EFFECTS,
1551 SPILL CLEANUP, PATENT, OIL SLICKS, DESIGN-ENGINEERING, BIODEGRADATION, BACTERIA,
1594 SPILL CLEANUP, MOVEMENT, MONITORING, ICE, CRUDE OIL, ARCTIC, SPREADING, WEATHERING,
1601 SPILL CLEANUP, REGULATIONS, OIL TRANSFER, NEW JERSEY, LEGISLATION, COMPENSATION, STATE GOVERNMENTS,
1604 SPILL CLEANUP, LIABILITY, LEGISLATION, COMPENSATION, US,
1627 SPILL CLEANUP, OIL SPILLS, HYDROCARBONS, BIODEGRADATION, BIBLIOGRAPHIES, BACTERIA, ALGAE,
1633 SPILL CLEANUP, OIL SPILLS, MARINE ORGANISMS, FATE, BIOLOGICAL EFFECTS, BIBLIOGRAPHIES,
1005 SPILL CONTAINMENT, OIL SPILLS, OFFSHORE DRILLING, NORTH SEA, *WELL BLOWOUT,
1009 SPILL CONTAINMENT, OIL SPILLS, OFFSHORE DRILLING, NORTH SEA, *EKOFISK WELL BLOWOUT,
1132 SPILL CONTAINMENT, PATENT, DESIGN-ENGINEERING, BOOMS,
1133 SPILL CONTAINMENT, PATENT, DESIGN-ENGINEERING, BOOMS,
1134 SPILL CONTAINMENT, *AIR BUBBLE SCREENS,
1135 SPILL CONTAINMENT, DESIGN-ENGINEERING, BOOMS, TANKERS,
1136 SPILL CONTAINMENT, PATENT, DESIGN-ENGINEERING, BOOMS, *FENDING DEVICE,
1137 SPILL CONTAINMENT, ABSORPTION, SPILL RECOVERY, *SORBENT PADS,
1138 SPILL CONTAINMENT, PATENT, HYDROCARBONS, DESIGN-ENGINEERING, BOOMS, ABSORPTION,
1139 SPILL CONTAINMENT, PATENT, HYDROCARBONS, DESIGN-ENGINEERING, BOOMS, ADSORPTION,
1172 SPILL CONTAINMENT, SPILL CLEANUP, SKIMMERS, MODELS, BOOMS, *HYDRODYNAMIC PROBLEMS,
1194 SPILL CONTAINMENT, RIVERS, ICE, CANADA, BOOMS, SPILL RECOVERY, *ST. CLAIR & DETROIT RIVERS,
1587 SPILL CONTAINMENT, OCEANS, MODELS, MARINE ORGANISMS, FATE, ENVIRONMENTAL EFFECTS, DISPERSIONS,
1142 SPILL DISPOSAL, OIL WELLS, INCINERATION, ICE, CANADA, ARCTIC, *BLOWOUTS,
1160 SPILL DISPOSAL, SOIL, PATENT, MICROORGANISMS, BIODEGRADATION,
1225 SPILL DISPOSAL, FUEL OIL, CRUDE OIL, ALASKA, STORAGE,
1271 SPILL DISPOSAL, COST ANALYSIS, WASTE OIL DISPOSAL, STORAGE, USCG,
1624 SPILL DISPOSAL, OIL TRANSFER, OIL SLICKS, ICE, BIODEGRADATION, BIBLIOGRAPHIES, ARCTIC,

CONTAINMENT, RECOVERY, STORAGE,
1137 SPILL RECOVERY, SPILL CONTAINMENT, ABSORPTION, *SORBENT PADS,
1141 SPILL RECOVERY, DESIGN-ENGINEERING, ABSORPTION, *FERROMAGNETIC FOAM,
1143 SPILL RECOVERY, SPILL CLEANUP, SKIMMERS, *STRAIT OF MALACCA,
1144 SPILL RECOVERY, DESIGN-ENGINEERING,
1146 SPILL RECOVERY, SKIMMERS, *CLEAN SWEEP OIL SKIMMER,
1148 SPILL RECOVERY, SKIMMERS, OIL-WATER SEPARATION, FUELS, DESIGN-ENGINEERING, WASTE OIL,
1154 SPILL RECOVERY, SKIMMERS, DESIGN-ENGINEERING, ABSORPTION,
1155 SPILL RECOVERY, PATENT, DESIGN-ENGINEERING, *UNDERWATER FISSURES,
1156 SPILL RECOVERY, PATENT, DESIGN-ENGINEERING,
1157 SPILL RECOVERY, POLLUTION PREVENTION, OIL SLICKS, USN, *GELATION, *AMINE CARBAMATES,
1161 SPILL RECOVERY, OIL TRANSFER, *PORTABLE PUMPS,
1165 SPILL RECOVERY, PATENT, DESIGN-ENGINEERING, ABSORPTION, *SORBENT BROADCASTER,
1166 SPILL RECOVERY, SKIMMERS, PATENT, DESIGN-ENGINEERING, CONTAMINANTS,
1167 SPILL RECOVERY, SKIMMERS, PATENT, DESIGN-ENGINEERING,
1169 SPILL RECOVERY, SKIMMERS, DESIGN-ENGINEERING, *OELA-III SKIMMER,
1170 SPILL RECOVERY, PATENT, DESIGN-ENGINEERING,
1171 SPILL RECOVERY, PATENT, ABSORPTION, *GLASS FIBER BLANKETS,
1176 SPILL RECOVERY, PATENT, ABSORPTION, *ABSORBENT POLYMERS,
1177 SPILL RECOVERY, SKIMMERS, PATENT, ABSORPTION, *ABSORBENT POWDER,
1178 SPILL RECOVERY, OIL-WATER SEPARATION, DESIGN-ENGINEERING,
1179 SPILL RECOVERY, PATENT, DESIGN-ENGINEERING, *OIL MOP RIGGING SYSTEM,
1180 SPILL RECOVERY, PATENT, DESIGN-ENGINEERING, *GUIDED JET,
1183 SPILL RECOVERY, PATENT, ADSORPTION,
1185 SPILL RECOVERY, DESIGN-ENGINEERING, CRUDE OIL, ABSORPTION, *SORBENTS,
1186 SPILL RECOVERY, PATENT, OIL-WATER SEPARATION, DESIGN-ENGINEERING,
1188 SPILL RECOVERY, SKIMMERS, ICE, FRESHWATER, CRUDE OIL, ARCTIC, *LOCKHEED CLEAN SWEEP,
1189 SPILL RECOVERY, SKIMMERS, DESIGN-ENGINEERING, *SLURP WEIR SKIMMER,
1190 SPILL RECOVERY, PETROLEUM PRODUCTS, PATENT, *ADHESIVE POLYMER FILM,
1194 SPILL RECOVERY, SPILL CONTAINMENT, RIVERS, ICE, CANADA, BOOMS, *ST. CLAIR & DETROIT RIVERS,
1195 SPILL RECOVERY, PATENT, DESIGN-ENGINEERING, *FLEXIBLE FLOATING PIPE,
1232 SPILL RECOVERY, OIL TANKS, EMULSIONS, BILGES, WASTE OIL TREATMENT, *DEMULSIFYING AGENTS,
1283 SPILL RECOVERY, PATENT, OIL SLICKS, ABSORPTION, WASTEWATER TREATMENT, *POLYURETHANE,
1345 SPILL RECOVERY, SKIMMERS, POLLUTION CONTROL, CANADA, *EQUIPMENT TESTING,
1582 SPILL RECOVERY, OIL SPILLS, OFFSHORE DRILLING, NORTH SEA, FATE, EVAPORATION, DISPERSIONS, *EKOFISK WELL BLOWOUT,
1222 SPREADING, SOCIO-ECONOMIC EFFECTS, OIL TRANSFER, OFFSHORE DEVELOPMENT, MODELS, ENVIRONMENTAL EFFECTS, COST ANALYSIS,
1223 SPREADING, PIPELINES, OIL TRANSPORT, OIL SPILLS, MODELS, LEAKAGE, FATE, EVAPORATION, *IGNITION HAZARDS,
1531 SPREADING, OIL SPILLS, OFFSHORE DRILLING, MOVEMENT, MARINE MAMMALS, FISH, ENVIRONMENTAL EFFECTS, BIRDS, BEAUFORT SEA,
1569 SPREADING, RIVERS, ICE, CRUDE OIL, COALESCENCE, BEHAVIOR, EMUSIFICATION,
1570 SPREADING, PHYSICAL EFFECTS, OIL SLICKS, DRIFT, WEATHERING,
1571 SPREADING, GROUNDWATER, CONTAMINATION, CALIFORNIA, WASTEWATER DISPOSAL,
1573 SPREADING, SOLUBILITY, OIL SPILLS, ICE, BEHAVIOR, ARCTIC, ABSORPTION, CLEANUP,
1576 SPREADING, OIL SPILLS, MOVEMENT, *WAVE INTERACTION ANALYSIS,
1594 SPREADING, SPILL CLEANUP, MOVEMENT, MONITORING, ICE, CRUDE OIL, ARCTIC, WEATHERING,
1598 SPREADING, OIL SPILLS, ICE, *OIL TEMPERATURE, *ICE TEMPERATURE, *SPILLING RATE,
1601 STATE GOVERNMENTS, SPILL CLEANUP, REGULATIONS, OIL TRANSFER, NEW JERSEY, LEGISLATION, COMPENSATION,
1602 STATE GOVERNMENTS, RECYCLING, LEGISLATION, WASTE OIL, *LOCAL GOVERNMENTS,
1608 STATE GOVERNMENTS, OIL DISCHARGES, LIABILITY, LEGISLATION, COMPENSATION, US, *NAVIGABLE WATERS,
1122 STATISTICAL ANALYSIS, SPILL CLEANUP, INFORMATION SYSTEMS, EPA, US, USCG,
1128 STATISTICAL ANALYSIS, SPECTROMETRY, SOURCE IDENTIFICATION, ANALTYTICAL TECHNIQUES,
1485 STATISTICAL ANALYSIS, OFFSHORE DEVELOPMENT, MONITORING, DISTRIBUTION, BIOLOGICAL EFFECTS, BENTHOS, BASELINE STUDIES, ALASKA/GULF OF, *PRODUCTIVITY,
1021 STATISTICS, OIL SPILLS, JAPAN, ENVIRONMENTAL DETERIORATION, *SETO INLAND SEA,
1379 STATISTICS, CONTAMINATION, BIRDS, BALTIC SEA, *MORTALITY,
1425 STATISTICS, CRUDE OIL, CONTAMINATION, BIRDS, BALTIC SEA, *MORTALITY, *GDANSK BAY,
1207 STORAGE, PIPELINES, OIL TRANSPORT, OIL TANKS, OIL SPILLS, OCS, ECONOMICS, ALASKA/GULF OF, TANKERS, *RISK ANALYSIS,
1208 STORAGE, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, *SALT DOMES, *TANK FARMS, *STRATEGIC PETROLEUM RESERVE,
1209 STORAGE, LOUISIANA, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, *BAYOU CHOCTAW SALT DOME,
1210 STORAGE, OIL TRANSPORT, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, WATER QUALITY, *BRYAN MOUND SALT DOMES,
1211 STORAGE, OIL SPILLS, KENTUCKY, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, WATER QUALITY, *CENTRAL ROCK MINE.
1212 STORAGE, OIL SPILLS, LOUISIANA, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, WATER QUALITY, *COTE BLANCHE MINE,
1213 STORAGE, OIL SPILLS, OHIO, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, WATER QUALITY,

*IRONTON MINE,
1214 STORAGE, OIL SPILLS, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, WATER QUALITY, TEXAS, *KLEER MINE,
1215 STORAGE, OIL SPILLS, LOUISIANA, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, WATER QUALITY, *WEEKS ISLAND MINE,
1216 STORAGE, OIL TRANSPORT, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, WATER QUALITY, *WEST HACKBERRY SALT DOME,
1217 STORAGE, FEA, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, CRUDE OIL, *STRATEGIC PETROLEUM RESERVE,
1225 STORAGE, SPILL DISPOSAL, FUEL OIL, CRUDE OIL, ALASKA,
1271 STORAGE, SPILL DISPOSAL, COST ANALYSIS, WASTE OIL DISPOSAL, USCG,
1623 STORAGE, SAFETY, PLANTS, OIL INDUSTRY, HEALTH HAZARDS, GUIDELINES, *BULK PETROLEUM
1624 STORAGE, SPILL DISPOSAL, OIL TRANSFER, OIL SLICKS, ICE, BIODEGRADATION, BIBLIOGRAPHIES, ARCTIC, CONTAINMENT, RECOVERY,
1629 SUBARCTIC REGIONS, OIL SPILLS, MARINE ORGANISMS, BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, BASELINE STUDIES, ARCTIC,
1081 SURFACTANTS, SAMPLING, PATENT, OIL SLICKS, DESIGN-ENGINEERING,
1159 SURFACTANTS, SPILL CLEANUP, PATENT, EMULSIONS, DISPERSANTS,
1193 SURFACTANTS, SOLVENTS, PHYTOPLANKTON, EMULSIFIERS, TOXICITY,
1311 SURFACTANTS, RECLAMATION, PATENT, LUBRICATING OIL,
1319 SURFACTANTS, RECLAMATION, PRECIPITATION, PATENT, LUBRICATING OIL, FLOCCULATION, WASTE OIL TREATMENT,
1549 SURFACTANTS, OXIDATION, HYDROCARBONS, BIODEGRADATION, BACTERIA, TOXICITY, *IONIC CONCENTRATION, *DETERGENTS,
1074 SURVEILLANCE, REMOTE SENSING, OIL SLICKS, DESIGN-ENGINEERING,
1324 SURVEILLANCE, SPILL CLEANUP, OIL DISCHARGES, LEGISLATION, DESIGN-ENGINEERING, CONTINGENCY PLANNING, US,
1343 SURVEILLANCE, SPILL CLEANUP, SOURCE IDENTIFICATION, POLLUTION PREVENTION, LAW ENFORCEMENT, USCG,
1093 SWEDEN, OIL SLICKS, HYDROCARBONS, CHEMICAL ANALYSIS,
1010 TANKERS, SAFETY, POLLUTION PREVENTION, US, *LIBERIAN REGISTRY LAWS,
1014 TANKERS, OIL SPILLS, ARGO MERCHANT SPILL, *LIBERIAN REGISTRY,
1019 TANKERS, SPILL CLEANUP, PORTUGAL, *JAKOB MAERSK SPILL,
1022 TANKERS, SPILL CLEANUP, LIABILITY, FISHERIES, ENVIRONMENTAL EFFECTS, ARGO MERCHANT SPILL,
1025 TANKERS, ENVIRONMENTAL EFFECTS, ARGO MERCHANT SPILL, *LIBERIAN FLAG OF CONVENIENCE,
1027 TANKERS, LEGISLATION, FISHERIES, ARGO MERCHANT SPILL, USCG, *NEW ENGLAND,
1030 TANKERS, SOURCES, SHIPS, OIL SPILLS,
1033 TANKERS, POLLUTION PREVENTION, OIL SLICKS, MONITORING, BALLAST, *OIL-WATER INTERFACE,
1042 TANKERS, PATENT, OIL SLICKS, MONITORING, DESIGN-ENGINEERING, BALLAST,
1115 TANKERS, OIL SPILLS, MODELS, ENVIRONMENTAL EFFECTS, ECONOMICS, *OPTIMAL TANKER SIZE,
1135 TANKERS, SPILL CONTAINMENT, DESIGN-ENGINEERING, BOOMS,
1200 TANKERS, POLLUTION PREVENTION, OIL SPILLS, LEGISLATION, US,
1202 TANKERS, PUGET SOUND, OIL TRANSPORT, OIL SPILLS, LEGISLATION, WASHINGTON,
1205 TANKERS, SEGREGATED BALLAST, REGULATIONS, POLLUTION CONTROL, ENVIRONMENTAL PROTECTION, COST ANALYSIS, USCG,
1207 TANKERS, STORAGE, PIPELINES, OIL TRANSPORT, OIL TANKS, OIL SPILLS, OCS, ECONOMICS, ALASKA/GULF OF, *RISK ANALYSIS,
1218 TANKERS, OIL TRANSPORT, OIL SPILLS, ENVIRONMENTAL EFFECTS, ALASKA, *VALDEZ NARROWS,
1219 TANKERS, OIL TRANSPORT, OIL SPILLS, OIL DISCHARGES, ENVIRONMENTAL EFFECTS, ECONOMICS, *SUPERTANKERS,
1220 TANKERS, OIL TRANSFER, MODELS, *ICE COOLING RATES,
1224 TANKERS, PORTS, OIL TRANSPORT, OIL SPILLS, ENVIRONMENTAL EFFECTS, ALASKA, *VALDEZ NARROWS,
1226 TANKERS, SAFETY, MEXICO/GULF OF, LIABILITY, CONTINGENCY PLANNING, ARGO MERCHANT SPILL, USCG, *FLAGS OF CONVENIENCE,
1304 TANKERS, RHINE RIVER, MONITORING, BILGES, WASTE OIL DISPOSAL, *COMPUTER SURVEILLANCE,
1330 TANKERS, REGULATIONS, POLLUTION CONTROL, OIL DISCHARGES, MONITORING, IMCO, *BAILEY MONITOR PROGRAM,
1339 TANKERS, POLLUTION CONTROL, NETHERLANDS, LEGISLATION, LAW ENFORCEMENT, HARBORS, WATER QUALITY,
1386 TANKERS, OIL SPILLS, MOVEMENT, ENVIRONMENTAL EFFECTS, ATLANTIC COAST, WWII SPILLS,
1402 TANKERS, PORTS, OIL SPILLS, METULA SPILL, MARSHES, MARINE ORGANISMS, BIOLOGICAL EFFECTS, UK, *MILFORD HAVEN,
1439 TANKERS, LIABILITY, INSURANCE, *MARINE INDUSTRY,
1449 TANKERS, SHIPS, OIL DISCHARGES, FATE, DISPERSANTS, CONTAMINATION, BIOLOGICAL EFFECTS,
1460 TANKERS, RIVERS, OIL TRANSFER, IRAQ, CONTAMINATION, WASTE OIL, *SHATT AL-ARAB,
1602 TANKERS, OIL TRANSPORT, OIL SPILLS, LIABILITY, LEGISLATION, CALIFORNIA,
1605 TANKERS, SAFETY, OIL SPILLS, LIABILITY, LEGISLATION, US, *CONGRESSIONAL BILLS,
1607 TANKERS, SHIPS, OIL SPILLS, LEGISLATION, INTERNATIONAL AGREEMENTS, US, *LEGAL PROBLEMS,
1610 TANKERS, PORTS, OIL TRANSPORT, LIABILITY, LEGISLATION, COST ANALYSIS, US, *DEEPWATER PORT ACT,
1613 TANKERS, POLLUTION PREVENTION, LEGISLATION, FRANCE, *FRENCH MARITIME LAW, *OLYMPIC BRAVERY SPILL,
1614 TANKERS, SEGREGATED BALLAST, REGULATIONS, POLLUTION CONTROL, INTERNATIONAL CONVENTIONS,

1617 TANKERS, POLLUTION PREVENTION, OIL-WATER SEPARATION, OIL DISCHARGES, MONITORING, INTERNATIONAL CONVENTIONS, IMCO,
1620 TANKERS, SAFETY, PETROLEUM PRODUCTS, OIL TRANSFER, GUIDELINES, CRUDE OIL, *TERMINALS,
1622 TANKERS, SAFETY, REGULATIONS, OIL TRANSPORT, LIABILITY, USCG,
1070 TAR, SOURCES, MONITORING, DISTRIBUTION, COASTS, BEAUFORT SEA,
1087 TAR, SAMPLING, CARIBBEAN SEA, ATLANTIC OCEAN,
1294 TAR SANDS, DEVELOPMENT, CANADA, WASTEWATER DISPOSAL, WATER QUALITY,
1099 TEXAS, OCS, MEXICO/GULF OF, HYDROCARBONS, DISTRIBUTION, CHEMICAL ANALYSIS, BENTHOS,
1214 TEXAS, STORAGE, OIL SPILLS, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, WATER QUALITY, *KLEER MINE,
1198 TORREY CANYON, RESTORATION, OLYMPIC GAMES SPILL, OIL SPILLS, CONTAMINATION, BIRDS,
1085 TOXICITY, SEDIMENTS, SAMPLING, OIL SPILLS, OCS, MISSISSIPPI, HYDROCARBONS, ESTUARIES, ALABAMA,
1090 TOXICITY, REFINERIES, MONITORING, ANALYTICAL TECHNIOUES, WASTEWATERS,
1150 TOXICITY, SPILL CLEANUP, MARINE ORGANISMS, DISPERSANTS, SOUTH AFRICA,
1163 TOXICITY, SPILL CLEANUP, ENGLAND, DISPERSANTS,
1193 TOXICITY, SURFACTANTS, SOLVENTS, PHYTOPLANKTON, EMULSIFIERS,
1286 TOXICITY, OXIDATION, HYDROCARBONS, CHEMICAL ANALYSIS, WASTEWATER TREATMENT, *AERATION,
1349 TOXICITY, OIL SPILLS, FISH, ESTUARIES, DELAWARE RIVER, *CORINTHOS SPILL,
1351 TOXICITY, MOLLUSKS, FUEL OIL, DISPERSIONS, CRUDE OIL, *OYSTER, *CRASSOSTREA, VIRGINICA,
1354 TOXICITY, OIL SPILLS, MICROORGANISMS, FUEL OIL, YEASTS, *ULTRAVIOLET LIGHT EXPOSURE,
1361 TOXICITY, PETROLEUM PRODUCTS, MARINE ORGANISMS, FISH, BLACK SEA, BENTHOS, *SHRIMP, *ELECTRICAL CURRENTS,
1366 TOXICITY, MOLLUSKS, FUEL OIL, CRUDE OIL, WASTE OIL, *CLAMS, *MERCENARIA,
1367 TOXICITY, BIOLOGICAL EFFECTS, BACTERIA, AROMATIC HYDROCARBONS,
1368 TOXICITY, CRUSTACEANS, CRUDE OIL, CHRONIC EFFECTS, ALASKA, ACUTE EFFECTS, *CANCER MAGISTER DANA, *WATER SOLUBLE FRACTION,
1369 TOXICITY, RED SEA, CRUDE OIL, CORALS, ACUTE EFFECTS, *HETEROXENIA FUSCESCENS,
1370 TOXICITY, HYDROCARBONS, FISH, CHRONIC EFFECTS, BERING SEA, ALASKA, ACUTE EFFECTS,
1372 TOXICITY, MARINE ORGANISMS, CONTAMINANTS, BEHAVIOR, *SUBLETHAL EFFECTS,
1373 TOXICITY, MARINE MAMMALS, HYDROCARBONS, ACUTE EFFECTS, *SEALS, *PHOCA VITULINA,
1375 TOXICITY, HYDROCARBONS, FUEL OIL, CONTAMINANTS, *FUEL ADDITIVES,
1382 TOXICITY, METABOLISM, MARINE ORGANISMS, CRUDE OIL, BACTERIA, *REFINED OIL, WEATHERING,
1385 TOXICITY, FUEL OIL, CRUDE OIL, COASTS, CANADA, BACTERIA, *GLUCOSE UPTAKE,
1390 TOXICITY, FUEL OIL, BEHAVIOR, ACUTE EFFECTS, ZOOPLANKTON, *WATER SOLUBLE FRACTIONS,
1391 TOXICITY, FUEL OIL, CRUSTACEANS, CRUDE OIL, *AMPHIPODS,
1395 TOXICITY, FISH, CRUDE OIL, ALASKA, *LIVER AND SKIN TISSUES,
1397 TOXICITY, PETROLEUM PRODUCTS, METABOLISM, INVERTEBRATES, FISH,
1398 TOXICITY, REFINERIES, FRESHWATER, FISH, ACUTE EFFECTS, WASTEWATERS, *REDEAR SUNFISH,
1399 TOXICITY, HYDROCARBONS, FISH, ACUTE EFFECTS, *FATHEAD MINNOWS,
1403 TOXICITY, MARINE ORGANISMS, FUEL OIL, ECHINODERMS, CRUDE OIL, *SAND DOLLARS,
1411 TOXICITY, INVERTEBRATES, CRUDE OIL, ARCTIC, *AMPHIPOD, *COELENTERATE,
1413 TOXICITY, PETROLEUM PRODUCTS, PETROCHEMICALS, FISH,
1414 TOXICITY, METABOLISM, MARINE ORGANISMS, CRUDE OIL, CHRONIC EFFECTS, ALASKA, ACUTE EFFECTS,
1419 TOXICITY, OFFSHORE DEVELOPMENT, FISHERIES, FISH, CRUDE OIL, ALASKA/GULF OF, ACUTE EFFECTS, *PACIFIC HERRING,
1420 TOXICITY, MARINE MAMMALS, CRUDE OIL, ACUTE EFFECTS, *RINGED SEALS,
1423 TOXICITY, MOLLUSKS, METABOLISM, FUEL OIL, CRUDE OIL, *CLAMS, *MYA ARENARIA,
1424 TOXICITY, OIL SPILLS, MOLLUSKS, INTERTIDAL ZONE, FUEL OIL, CHRONIC EFFECTS, ACUTE EFFECTS, *HONG KONG,
1427 TOXICITY, PHYTOPLANKTON, MARINE ORGANISMS, EMULSIFIERS,
1430 TOXICITY, MOLLUSKS, FUEL OIL, EMULSIONS, DISPERSANTS, CRUDE OIL, UK,
1433 TOXICITY, SOLVENTS, FISH, DISPERSANTS, ACUTE EFFECTS, *FISH LARVAE,
1434 TOXICITY, FUEL OIL, ALGAE, *GROWTH RATES, *PHENALEN-1-ONE,
1456 TOXICITY, PETROLEUM PRODUCTS, *CONTROLLED MARINE ECOSYSTEMS ,
1457 TOXICITY, REFINERIES, OIL SPILLS, MONITORING, DISPERSANTS, CONTAMINATION, *BOOK REVIEW,
1483 TOXICITY, OFFSHORE DEVELOPMENT, MARINE MAMMALS, BERING SEA, BASELINE STUDIES, *MORTALITY,
1504 TOXICITY, OIL WELLS, FISH, DRILLING, ARCTIC, ACUTE EFFECTS, *TROUT, *DRILLING MUDS,
1506 TOXICITY, OIL WELLS, FISH, ENVIRONMENTAL EFFECTS, DRILLING, *SALMON, *DRILLING MUDS,
1547 TOXICITY, PETROLEUM PRODUCTS, MONITORING, CRUSTACEANS, CRUDE OIL, BIODEGRADATION, ARCTIC, *AMPHIPODS,
1549 TOXICITY, SURFACTANTS, OXIDATION, HYDROCARBONS, BIODEGRADATION, BACTERIA, *IONIC CONCENTRATION, *DETERGENTS,
1572 TOXICITY, SOLUTION, OIL SPILLS, MODELS, HYDROCARBONS, EVAPORATION, CRUDE OIL,
1363 TROPICAL REGIONS, MARINE ORGANISMS, INTERTIDAL ZONE, FUEL OIL, CORALS, BIOLOGICAL EFFECTS,
1006 UK, HEALTH HAZARDS, ECONOMICS, DISPOSAL, WASTE OIL,
1012 UK, MONITORING, CONTAMINATION, BIRDS, *BIRD MORTALITY,
1026 UK, ENVIRONMENTAL PROTECTION, BALTIC SEA, USSR, *JOINT UK/USSR COMMITTEE,
1032 UK, SEDIMENTS, MONITORING, MARINE ORGANISMS, DISTRIBUTION, BENTHOS, *SUBLITTORAL MACROFAUNA, *MILFORD HAVEN,
1206 UK, PORTS, OIL TRANSFER, OIL DISCHARGES, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS,

*MILFORD HAVEN,
1316 UK, RECLAMATION, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, CONSERVATION, WASTE OIL,
1335 UK, OIL SPILLS, OIL INDUSTRY, MONITORING, LEGISLATION, ENVIRONMENTAL EFFECTS, WASTEWATERS,
1346 UK, SHIPS, POLLUTION CONTROL, OIL SPILLS, LAW ENFORCEMENT, HARBORS, *MILFORD HAVEN,
1357 UK, REFINERIES, PORTS, OIL SPILLS, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, WASTEWATERS, *MILFORD HAVEN,
1358 UK, REFINERIES, PORTS, OIL SPILLS, MONITORING, BIOLOGICAL EFFECTS, WASTEWATERS, *MILFORD HAVEN, *OIL POLLUTION RESEARCH UNIT,
1359 UK, SHORELINES, REFINERIES, MARSHES, BIOLOGICAL EFFECTS, WASTEWATERS, VEGETATION,
1371 UK, REFINERIES, MARSHES, BIOLOGICAL EFFECTS, WASTEWATERS, VEGETATION, *SALTMARSH,
1393 UK, POLYCHAETES, DISPERSANTS, CRUDE OIL, BIOLOGICAL EFFECTS, *ARENICOLA MARINA L, *MILFORD HAVEN,
1402 UK, TANKERS, PORTS, OIL SPILLS, METULA SPILL, MARSHES, MARINE ORGANISMS, BIOLOGICAL EFFECTS, *MILFORD HAVEN,
1430 UK, TOXICITY, MOLLUSKS, FUEL OIL, EMULSIONS, DISPERSANTS, CRUDE OIL,
1451 UK, SPILL CLEANUP, PORTS, POLLUTION PREVENTION, OIL TRANSFER, LEAKAGE, ENVIRONMENTAL EFFECTS, *MILFORD HAVEN,
1054 UPTAKE, MONITORING, METABOLISM, MARINE ORGANISMS, HYDROCARBONS, ANALYTICAL TECHNIQUES,
1058 UPTAKE, RELEASE, MONITORING, MOLLUSKS, METABOLISM, MANUALS, HYDROCARBONS,
1063 UPTAKE, SEDIMENTS, RELEASE, MONITORING, INTERTIDAL ZONE, CRUDE OIL, ALASKA, *PORT VALDEZ,
1362 UPTAKE, RELEASE, PETROLEUM PRODUCTS, PAH, FISH, *3,4-BENZOPYRENE,
1377 UPTAKE, RELEASE, METABOLISM, HYDROCARBONS, FISH, CRUSTACEANS, *LABELED N-ALKANES,
1385 UPTAKE, TOXICITY, FUEL OIL, CRUDE OIL, COASTS, CANADA, BACTERIA, *GLUCOSE
1396 UPTAKE, RELEASE, HYDROCARBONS, FISH, CRUSTACEANS, BIOLOGICAL EFFECTS, ALASKA, *BIOTRANSFORMATION,
1404 UPTAKE, METABOLISM, BIOLOGICAL EFFECTS, ALGAE, *PHOTOSYNTHESIS, *RESPIRATION,
1416 UPTAKE, RELEASE, POLYCHAETES, FUEL OIL, AROMATIC HYDROCARBONS, *NAPHTHALENE, *NEANTHES ARENACEODENTATA,
1455 UPTAKE, RELEASE, HYDROCARBONS, FISH, *BENZENE, *NORTHERN ANCHOVY, *STRIPED BASS,
1561 UPTAKE, METABOLISM, CRUDE OIL, BIODEGRADATION, BEAUFORT SEA, BASELINE STUDIES, BACTERIA, ALASKA/GULF OF, ACUTE EFFECTS,
1453 URQUIOLA SPILL, SPILL CLEANUP, SPAIN, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, DISPERSANTS,
1010 US, TANKERS, SAFETY, POLLUTION PREVENTION, *LIBERIAN REGISTRY LAWS,
1122 US, STATISTICAL ANALYSIS, SPILL CLEANUP, INFORMATION SYSTEMS, EPA, USCG,
1200 US, TANKERS, POLLUTION PREVENTION, OIL SPILLS, LEGISLATION,
1324 US, SURVEILLANCE, SPILL CLEANUP, OIL DISCHARGES, LEGISLATION, DESIGN-ENGINEERING, CONTINGENCY PLANNING,
1521 US, OIL SHALE, OFFSHORE PRODUCTION, ENVIRONMENTAL EFFECTS, DEVELOPMENT,
1604 US, SPILL CLEANUP, LIABILITY, LEGISLATION, COMPENSATION,
1605 US, TANKERS, SAFETY, OIL SPILLS, LIABILITY, LEGISLATION, *CONGRESSIONAL BILLS,
1606 US, ONSHORE IMPACTS, OIL-GAS LEASING, OFFSHORE DEVELOPMENT, LEGISLATION, ENVIRONMENTAL PROTECTION, *OCS LANDS ACT AMENDMENTS,
1607 US, TANKERS, SHIPS, OIL SPILLS, LEGISLATION, INTERNATIONAL AGREEMENTS, *LEGAL PROBLEMS,
1608 US, STATE GOVERNMENTS, OIL DISCHARGES, LIABILITY, LEGISLATION, COMPENSATION, *NAVIGABLE WATERS,
1609 US, PRODUCTION, LEGISLATION, EPA, WATER QUALITY, *UNDERGROUND INJECTION,
1610 US, TANKERS, PORTS, OIL TRANSPORT, LIABILITY, LEGISLATION, COST ANALYSIS, *DEEPWATER PORT ACT,
1611 US, POLLUTION PREVENTION, OIL DISCHARGES, LIABILITY, LEGISLATION, FOREIGN GOVERNMENTS,
1027 USCG, TANKERS, LEGISLATION, FISHERIES, ARGO MERCHANT SPILL, *NEW ENGLAND,
1122 USCG, US, STATISTICAL ANALYSIS, SPILL CLEANUP, INFORMATION SYSTEMS, EPA,
1145 USCG, SPILL CLEANUP, SAFETY, REGULATIONS, POLLUTION PREVENTION,
1205 USCG, TANKERS, SEGREGATED BALLAST, REGULATIONS, POLLUTION CONTROL, ENVIRONMENTAL PROTECTION, COST ANALYSIS,
1226 USCG, TANKERS, SAFETY, MEXICO/GULF OF, LIABILITY, CONTINGENCY PLANNING, ARGO MERCHANT SPILL, *FLAGS OF CONVENIENCE,
1271 USCG, STORAGE, SPILL DISPOSAL, COST ANALYSIS, WASTE OIL DISPOSAL,
1343 USCG, SURVEILLANCE, SPILL CLEANUP, SOURCE IDENTIFICATION, POLLUTION PREVENTION, LAW ENFORCEMENT,
1622 USCG, TANKERS, SAFETY, REGULATIONS, OIL TRANSPORT, LIABILITY,
1071 USGS, REMOTE SENSING, OIL SLICKS, DETECTION, *LANDSAT IMAGERY,
1157 USN, SPILL RECOVERY, POLLUTION PREVENTION, OIL SLICKS, *GELATION, *AMINE CARBAMATES,
1255 USN, RECLAMATION, DISPOSAL, WASTE OIL TREATMENT,
1026 USSR, UK, ENVIRONMENTAL PROTECTION, BALTIC SEA, *JOINT UK/USSR COMMITTEE,
1108 USSR, SEDIMENTS, PORTS, PETROLEUM PRODUCTS, OCEANS, CONTAMINATION, CHEMICAL ANALYSIS,
1268 USSR, SLUDGE, REFINERIES, INCINERATION, WASTEWATER TREATMENT,
1279 USSR, RIVERS, REFINING, PETROLEUM PRODUCTS, PETROCHEMICALS, CONTAMINATION, WASTE OIL,
1441 USSR, PETROLEUM PRODUCTS, OIL TANKS, GROUNDWATER, CONTAMINATION, CHEMICAL ANALYSIS,
1560 USSR, SEDIMENTS, COASTS, BLACK SEA, BIODEGRADATION, BACTERIA, *COASTAL WATERS,
1359 VEGETATION, UK, SHORELINES, REFINERIES, MARSHES, BIOLOGICAL EFFECTS, WASTEWATERS,
1364 VEGETATION, OIL SPILLS, ENVIRONMENTAL DETERIORATION, WASHINGTON, *ALPINE MEADOW,
1371 VEGETATION, UK, REFINERIES, MARSHES, BIOLOGICAL EFFECTS, WASTEWATERS, *SALTMARSH,

1094 WASHINGTON, SPECTROSCOPY, SEDIMENTS, PUGET SOUND, MARINE ORGANISMS, HYDROCARBONS, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES,
1202 WASHINGTON, TANKERS, PUGET SOUND, OIL TRANSPORT, OIL SPILLS, LEGISLATION,
1364 WASHINGTON, VEGETATION, OIL SPILLS, ENVIRONMENTAL DETERIORATION, *ALPINE MEADOW,
1006 WASTE OIL, UK, HEALTH HAZARDS, ECONOMICS, DISPOSAL,
1049 WASTE OIL, SPECTROMETRY, MONITORING, DETECTION, BILGES, BALLAST, ANALYTICAL TECHNIQUES, *SUMMING LUMINESCENCE SPECTROMETRY,
1055 WASTE OIL, SAMPLING, REFINERIES, MONITORING, WASTEWATERS,
1113 WASTE OIL, PETROCHEMICALS, INDUSTRIES, ANALYTICAL TECHNIQUES, *X-RAY FLUORESCENCE,
1148 WASTE OIL, SPILL RECOVERY, SKIMMERS, OIL-WATER SEPARATION, FUELS, DESIGN-ENGINEERING,
1182 WASTE OIL, SPILL CLEANUP, SEAWATER, RIVERS, PATENT, ABSORPTION,
1250 WASTE OIL, SOURCES, RECLAMATION, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, DISPOSAL,
1279 WASTE OIL, USSR, RIVERS, REFINING, PETROLEUM PRODUCTS, PETROCHEMICALS, CONTAMINATION,
1305 WASTE OIL, SLUDGE, RECYCLING, OIL-WATER SEPARATION, DISPOSAL,
1308 WASTE OIL, RECLAMATION, INDUSTRIES, DESIGN-ENGINEERING,
1313 WASTE OIL, RECLAMATION, PATENT, LUBRICATING OIL, FILTRATION,
1314 WASTE OIL, REUSE, RECLAMATION, FUEL OIL, WASTEWATER TREATMENT, *MEMBRANE TECHNIQUES,
1315 WASTE OIL, RECYCLING, LUBRICATING OIL, ENGLAND,
1316 WASTE OIL, UK, RECLAMATION, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, CONSERVATION,
1317 WASTE OIL, REUSE, REFINING, RECLAMATION, LUBRICATING OIL, GOVERNMENT AGENCIES,
1320 WASTE OIL, REFINING, RECLAMATION, PATENT, LUBRICATING OIL,
1366 WASTE OIL, TOXICITY, MOLLUSKS, FUEL OIL, CRUDE OIL, *CLAMS, *MERCENARIA,
1394 WASTE OIL, SOIL, FUNGI, CRUDE OIL, BIOLOGICAL EFFECTS, BIODEGRADATION,
1460 WASTE OIL, TANKERS, RIVERS, OIL TRANSFER, IRAQ, CONTAMINATION, *SHATT AL-ARAB,
1602 WASTE OIL, STATE GOVERNMENTS, RECYCLING, LEGISLATION, *LOCAL GOVERNMENTS,
1234 WASTE OIL DISPOSAL, OIL-WATER SEPARATION, FILTRATION, EMULSIONS,
1271 WASTE OIL DISPOSAL, USCG, STORAGE, SPILL DISPOSAL, COST ANALYSIS,
1304 WASTE OIL DISPOSAL, TANKERS, RHINE RIVER, MONITORING, BILGES, *COMPUTER SURVEILLANCE,
1232 WASTE OIL TREATMENT, SPILL RECOVERY, OIL TANKS, EMULSIONS, BILGES, *DEMULSIFYING AGENTS,
1244 WASTE OIL TREATMENT, RECLAMATION, PATENT, LUBRICATING OIL,
1254 WASTE OIL TREATMENT, DISPOSAL, *WASTE MANAGEMENT,
1255 WASTE OIL TREATMENT, USN, RECLAMATION, DISPOSAL,
1262 WASTE OIL TREATMENT, PETROLEUM PRODUCTS, ACTIVATED SLUDGE,
1309 WASTE OIL TREATMENT, *ENERGY SOURCES, SOLID WASTES,
1310 WASTE OIL TREATMENT, RECLAMATION, LUBRICATING OIL, *BERC/ERDA SOLVENT,
1319 WASTE OIL TREATMENT, SURFACTANTS, RECLAMATION, PRECIPITATION, PATENT, LUBRICATING OIL, FLOCCULATION,
1016 WASTEWATERS, SOURCES, ITALY, HYDROCARBONS, CONTAMINATION, *GULF OF TRIESTE,
1028 WASTEWATERS, SOURCES, REFINERIES, INFORMATION SYSTEMS, INDUSTRIES, ECONOMIC EFFECTS, CONTAMINATION,
1039 WASTEWATERS, PETROLEUM PRODUCTS, PATENT, MONITORING, HYDROCARBONS, BALLAST, *SOUND VELOCITY CHARACTERISTICS,
1055 WASTEWATERS, WASTE OIL, SAMPLING, REFINERIES, MONITORING,
1067 WASTEWATERS, REFINERIES, MONITORING, CHEMICAL ANALYSIS, AROMATIC HYDROCARBONS, *COLORIMETRY,
1078 WASTEWATERS, REMOTE SENSING, OCS, ESTUARIES, DISPERSIONS, *CURRENT CIRCULATION,
1090 WASTEWATERS, TOXICITY, REFINERIES, MONITORING, ANALYTICAL TECHNIQUES,
1096 WASTEWATERS, SAMPLING, POLLUTION CONTROL, OIL INDUSTRY, ANALYTICAL TECHNIQUES, WATER QUALITY, *ON-LINE INSTRUMENTATION,
1097 WASTEWATERS, DETECTION, CHEMICAL ANALYSIS, *OIL TRACES, *ADSORPTION POLAROGRAPHY,
1104 WASTEWATERS, HYDROCARBONS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, *GASOLINE FRACTIONS,
1114 WASTEWATERS, HYDROCARBONS, *SPECTRAL ABSORPTION CHARACTERISTICS, *HYDROCARBON CONCENTRATION,
1118 WASTEWATERS, NEW YORK, MARINE ORGANISMS, HYDROCARBONS, DETECTION, CRANKCASE OIL, CHEMICAL ANALYSIS,
1235 WASTEWATERS, SKIMMERS, OIL-WATER SEPARATION, INLAND, DESIGN-ENGINEERING, *AFL INDUSTRIES,
1288 WASTEWATERS, SOLID WASTES, OIL INDUSTRY, INDUSTRIES, DISPOSAL,
1289 WASTEWATERS, SOURCES, REFINERIES, ACTIVATED SLUDGE, WASTEWATER TREATMENT, *OXIDATION LAGOONS, *ACTIVATED CARBON,
1335 WASTEWATERS, UK, OIL SPILLS, OIL INDUSTRY, MONITORING, LEGISLATION, ENVIRONMENTAL EFFECTS,
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Alternatives: Perspectives on Society and Environment
Ambio
American Fisheries Society Transactions
Applied Ecology Abstracts
Applied Energy
Applied Microbiology
Applied Science & Technology Index
Aquatic Sciences & Fisheries Abstracts
Audubon
Australian Science Index
Berichte der Deutschen Wissenschaftlichen Komission fuer
    Meeresforschung
Biological Abstracts
Bioscience
British Birds
Bulletin of Environmental Contamination and Toxicology
Chemical Abstracts
Chemical and Engineering News
Chemical Engineering
Chemical Engineering Progress
Chemical Week
Chemistry in Canada
Chemosphere
Current Contents: Life Sciences
Current Contents: Physical and Chemical Sciences
Deep-Sea Research
Ecolibrium
Ecological Abstracts
Ecological Modelling
Ecology Law Quarterly
Energy Information Abstracts
Energy Review
Environment
Environment Abstracts
Environmental Action
Environmental Conservation
Environmental Geology
Environmental Health and Pollution Control
Environmental Periodicals Bibliography
Environmental Pollution
Environmental Science & Technology
Environmetal Technology and Economics
EPA Reports Bibliography Quarterly
ERDA Energy Research Abstracts
Erdoel und Kohle Erdgas Petrochemie vereinigt mit Brennstoffchemie
Estuarine and Coastal Marine Science
Fuel Abstracts and Current Titles
Government Reports Announcements

Hydrocarbon Processing
IMS Newsletter
India Journal of Environmental Health
Industrial Wastes Information Bulletin
International Aerospace Abstracts
International Journal of Ecology and Environmental Science
International Journal of Environmental Analytical Chemistry
International Petroleum Abstracts
Iranian Journal of Science and Technology
Journal of Canadian Petroleum Technology
Journal of Chromatography
Journal of Environmental Science and Health
Journal of Environmental Sciences
Journal of Petroleum Technology
Journal of the Fisheries Research Board of Canada
Journal of Toxicology and Environmental Health
Limnology and Oceanography
Marine Biological Association of the United Kingdom, Journal
Marine Biology
Marine Chemistry
Marine Fisheries Review
Marine Geology
Marine Geotechnology
Marine Policy
Marine Pollution Bulletin
Marine Science Contents Tables
Marine Technology Society, Journal
Maritime Research Information Service Abstracts
Massachusetts Audubon
Microbial Ecology
National Fisherman
National Research Council, News Report
National Wildlife
Nature
New Technical Books
Nippon Susan Gakkai Shi. Bulletin of the Japanese Society of Scientific Fisheries
Ocean Engineering
Ocean Industry
Ocean Management
Oceanic Abstracts
Oceanus
Offshore
Oil and Gas Journal
Outdoor California
Pacific Oil World
Petroleum Abstracts
Petroleum Engineer International
Petroleum Today
Pollution Abstracts
Pollution Engineering
Proceedings in Print

Resources
Resource Recovery and Conservation
Royal Society of London, Proceedings, Series B, Biological Sciences
Science
Science News
Science of the Total Environment
Scientific and Technical Aerospace Reports
Sea Frontiers
Sea Secrets
Sea Technology
Selected References on Environmental Quality
Selected Water Resources Abstracts
Technical Book Review
The Ecologist
The Engineering Index
The Sciences
UDS Water Quality Control Digest
Underwater Information Bulletin
Underwater Naturalist
Water, Air, and Soil Pollution
Water Pollution Control
Water Pollution Control Federation, Journal
Water Research
WRC Information
Western Fisheries

U.S. Environmental Protection Agency
Industrial Environmental Research Laboratory
Edison, New Jersey 08817

We are requesting your assistance upon receiving the report ("Oil Spill and Oil Pollution Reports, May 1977 - July 1977").

Is the information usable?
Is the format helpful?

We invite your comments and suggestions. Thank you.

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Mr. J. S. Dorrler
Industrial Environmental Research Laboratory
U.S. Environmental Protection Agency
Edison, New Jersey 08817